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Issue #281

73®

Amateur Radio's Technical Journal

A Wayne Green Publication

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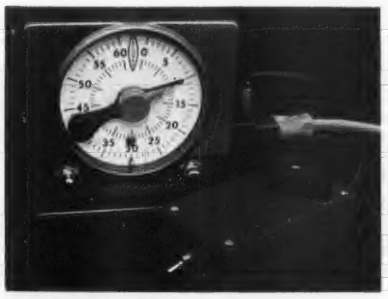

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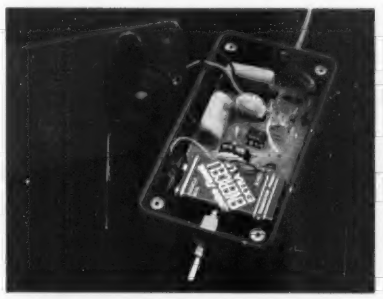

This Antenna Is Too Good To Be True
It's cheap. It works well on all bands. And it radiates a super signal. W4HDX 10

Construct the Minuteman Timer
As faithful as a grandfather clock, this timer tells when to ID—and when not to. KA8QBQ 14

The Secret of Remote Control
Inside those miniature planes lie some sophisticated circuits. WB3BQO 18

Calculate Your FT-101
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Put the DX World on a Screen
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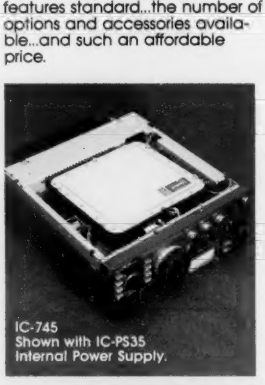

IC-745
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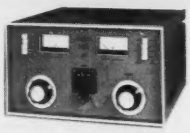

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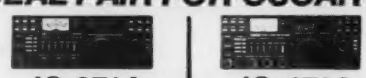

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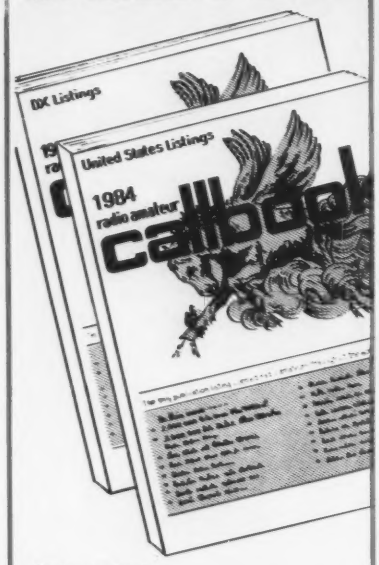

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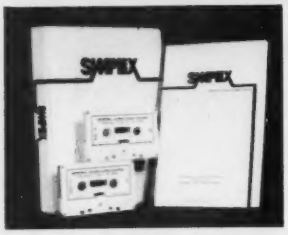

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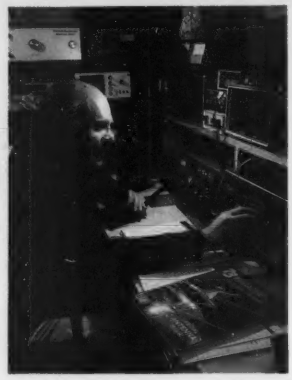

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

EGO

Yes, when you write to Wayne Green, I get your letters. Usually I answer, too, much to the surprise of a lot of hams. There is some sort of weird concept that because someone is rich and famous, he is no longer reachable.

Ha! There's that Wayne Green ego again—rich and famous, indeed! Well, golly, I *am* rich in some ways—and though I've worked a lot harder than most people to get this way, many begrudge it. I've been writing for how many years now telling you how to get rich? I wrote a booklet on the subject twenty years ago. And fame? Well, I'm well known in a couple of esoteric circles, if that qualifies. Wayne Green is not yet a household term.

Several letters of interest arrived in the last few days. One chap advised me that he was canceling his subscription because my ego is too big and three thanked me for egging them on to become entrepreneurs and making them rich. Well, I don't know what to do about my ego except ask you to live with it and enjoy it the way I do. Without my ego prodding me, I'm not sure where a lot of things would be.

It's a funny thing about "rich." Sure, I have millions to spend just about any way I want, so what am I doing with all of that loot? Well, for the most part, I am using it to help people with ideas bring them to fruit and to make some of my own ideas work. A plane? Nope, I tried that almost 30 years ago, back in '57, and got it out of my system. A big house, right? Tried that in '69 and didn't like it. No, I have a small room over my office which is all I need for the few hours I waste sleeping each day. I've been putting in hundred-hour weeks for years and enjoying it.

A few weeks ago, I attended an evening class in the art of conversation here in Peterborough. Each of us was asked to explain why we'd come to the class. My rationalization was that I really didn't know how to cope with cocktail parties. What in the hell can one possibly talk about when meeting someone for the first time in a noisy room where the meeting will be for only a few minutes? As I explained, I realized that I had exactly outlined one of the big problems with amateur radio—we meet new people under noisy conditions and are expected to provide some entertainment.

I was assured by everyone else in the class that my prob-

Continued on page 100

HELP WANTED

73 is currently seeking a TECHNICAL/INTERNATIONAL EDITOR. The position requires excellent written and oral communications skills, as well as a General-class or higher ticket. Experience with microcomputers would be a help. Responsibilities include participating in manuscript review, organizing and implementing special projects, and supervising our staff of foreign correspondents.

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- **"BEEPER" sounds through speaker.**
- **Easy-to-Install mobile mount**

TW-4000A accessories:

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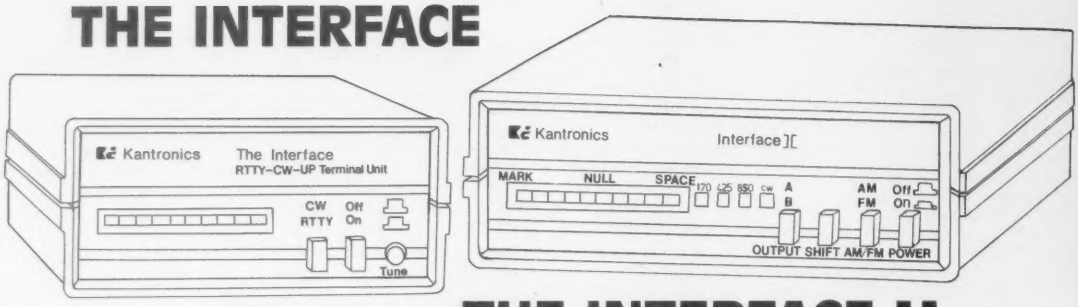

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WE'LL TALK TO YOU
REAL SOON . . . 73'S . . . .
WA5RGU
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TIME FOR DINNER SO 73'S WØXI

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This antenna is a combination of the old reliable Zepp with the addition of a balanced, shielded feeder system which has been described in various articles in past years.

This antenna has been in use at this QTH as well as other locations for over two years and has yielded many fine DX contacts and many good reports stateside.

To determine the comparable merit of this antenna, I erected separate dipoles cut for the center of each band and fed with a single coaxial cable. Then I connected all antennas so they could be switched rapidly to determine the comparable signal strength of each as compared to the Zepp antenna.

In addition to the favorable signal strength comparisons, I also found that the noise level on the Zepp antenna was as much as 5 S-units lower than the noise on the cut-to-frequency dipole with single coax feed. I noticed this particularly on

Desired Bands of Operation	Length of Each Side of Antenna From Center to Each End
160–10 meters	108 feet
80–10 meters	54 feet
40–10 meters	27 feet
30–10 meters	18.7 feet
20–10 meters	13.5 feet
17–10 meters	10.4 feet
15–10 meters	9 feet
12–10 meters	7.8 feet

Table 1.

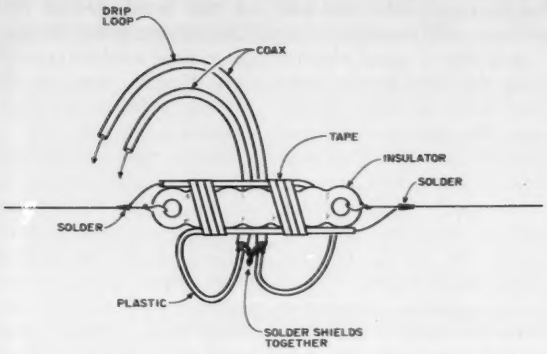

Fig. 1. Method of supporting coax cables.

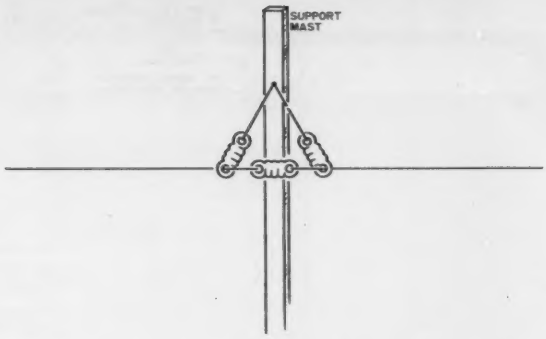

Fig. 2. Method of supporting antenna at center.

the model of this antenna which was erected inside the attic of the house in close proximity to the ac wiring of the building, where the noise level dropped from an S-7 on the regular dipole to an S-2 on the Zepp antenna.

To erect this antenna, you simply figure the length of each side of the flat-top from the center to one end by using the figures shown in Table 1.

This antenna can be cut for operation an any combination of the HF ham bands, including the WARC bands which have not yet been released. For example, if your space is limited, you could put an antenna in the attic of the house, as I did at one location where I had an attic length of only about 30 feet, by figuring the antenna for operation on the bands from 30 through 10 meters, resulting in a length each side of center of 18.67 feet. Then I ran the wire in a Z configuration through the attic to compress it into the available space.

I have used various configurations on this antenna, such as the halo and the inverted vee, and all give good results. If you can get the wire running in a fairly straight line, though, your radiation pattern will be more predictable.

The flat-top portion is designed so that it is non-resonant on all bands of operation, thereby avoiding any extremely high or extremely low impedance points at the feedpoint. It is designed to be resonant between the one-quarter, half, three-quarter, and full-wave points on each band, thereby presenting an impedance to the antenna tuner which is well within range of the tuner on each band and will not cause any loading problems. An antenna tuner is required which has a built-in balun or you must use a 4-to-1 balun at the bottom end of the line if you don't have one built in the tuner itself.

The feedline is made of two runs of RG-8/U cable for powers up to 2 kW PEP, or for low-power operation under 100 Watts output, RG-58/U cable may be used. The lower loss of the larger cable is to be desired, however, even if low power is used.

At the top end of the feedline, you connect the shields of the two coax cables together but *do not* connect them to anything else. Then at the bottom end of the line, the shields are tied together and connected to the ground connection in the shack and to the frame of the tuner.

The inner conductors of the coax cables are tied to each leg of the antenna wire at the top of the line, and at the bottom end of the line they are connected to each of the balanced-output terminals of the antenna tuner.

The feedline can be run anywhere—underground, through metal or vinyl conduit, or in the open. The advantage of this arrangement, however, is that unlike the old open-wire feedline previously used on Zepp antennas, it does not have to be kept clear of surrounding objects and is not affected by anything it lies against.

There is only one precaution that must be observed, and that is to cut both runs of the cable exactly the same length. They do not have to be run together, however, as the shield on the cables provides exact electrical separation of the inner conductors even if the two cables are widely separated.

As to the length of the feedline, I found that best results were observed with line lengths of a little more than one-quarter wavelength at the lowest frequency of operation (or anything longer than that). Try to avoid making the feedline resonant at any particular frequency you are operating on, particularly the quarter-wave points, or you may have a bit of trouble tuning on this band. Optimum length seemed to be about 55 feet for 80-through-10-meter operation.

As for the mechanical construction, it is a good idea to use a long insulator, the same type used on the ends of the antenna, at the center of the antenna. Then slip the end of another insulator of the same type over the wire on either side of the center insulator, coming off at right angles to the wire and tying the support wire to these two side insulators so that equal pull is achieved on either side of the center insulator. Then

Center support and coaxial connections.

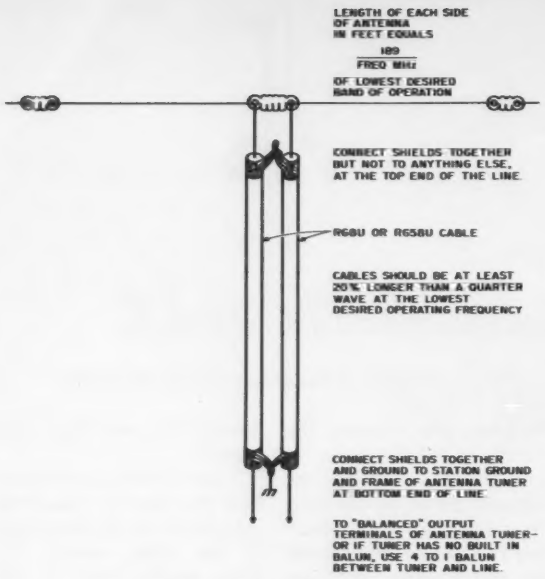
LENGTH OF EACH SIDE OF ANTENNA IN FEET EQUALS
468
FREQ MHz
OF LOWEST DESIRED BAND OF OPERATION
CONNECT SHIELDS TOGETHER BUT NOT TO ANYTHING ELSE, AT THE TOP END OF THE LINE.
RG8U OR RG58U CABLE
CABLES SHOULD BE AT LEAST 20% LONGER THAN A QUARTER WAVE AT THE LOWEST DESIRED OPERATING FREQUENCY
CONNECT SHIELDS TOGETHER AND GROUND TO STATION GROUND AND FRAME OF ANTENNA TUNER AT BOTTOM END OF LINE.
TO "BALANCED" OUTPUT TERMINALS OF ANTENNA TUNER— OR IF TUNER HAS NO BUILT IN BALUN, USE 4 TO 1 BALUN BETWEEN TUNER AND LINE.

Fig. 3. Allband trapless antenna for HF.

at the point where you need to support the two coax cables, just strip off about 2 feet of the braid, leaving the plastic inner insulation, and bend this part along the center insulator on each side and tape securely to the insulator. This will make a very solid support for the coax cables and will prevent wind damage.

It is also a good idea to bring the coax up the support mast a little higher than the antenna wire and bend it over in a loop and down about a foot or so to prevent the water from leaking into and running down the inside of the shield on the cables.

To separate the braid from the inner conductor on the coax, strip the outside plastic covering off about two feet from the end, then take the end of the shield and push it down, compressing it so that it becomes larger in diameter. Then take an awl or the tip of a small screwdriver and carefully spread the strands of the braid apart, opening up a hole in one side of the braid. At this point, bend the coax in a U shape and pull the plastic insulated center conductor out through the hole in the side of the braid, U-end first. This will eliminate the need for making a solder connection directly next to the plastic where it might create a weak spot.

I have used this antenna in various situations cut for all different combinations of bands and have had excellent results with all of them. I have also made up a portable version of this antenna using stranded insulated wire such as zip-cord and RG-58/U cables which I use in conjunction with a small antenna tuner for operation on 20 through 10 meters. This one is only 13.5 feet long either side of center with two runs of coax 20 feet long. It is ideal for stringing up in a motel room or apartment by supporting it with nylon fishing line. Just keep the antenna out a foot or so from the wall and support it by anything you can find to tie it to. Try it. You'll like it!■

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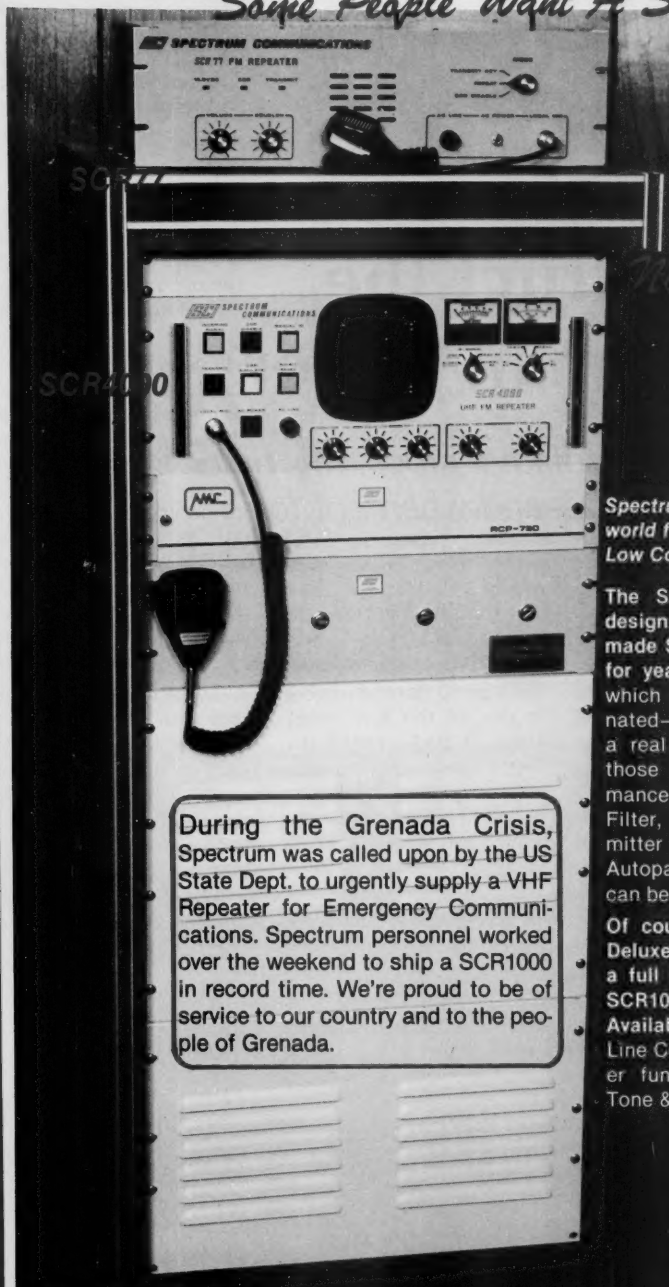

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Construct the Minuteman Timer

As faithful as a grandfather clock, this timer tells when to ID—and when not to.

Gary L. Fait KA8QBQ
302 E. Lexington St.
Davison MI 48423

"But why do you need another ID timer?" my wife asked when she saw me trying to sneak yet another Radio Shack bag to the workbench.

The question was no surprise because my very first electronics project had been an ID timer described in one of the ham magazines. It had worked perfectly, and I remembered well how I had shown it to her and carefully explained why I had added a single LED to the circuit for a visual signal.

The answer to her question, however, was that this timer is even better but it is still simple. Using a seven-segment LED, the timer steps off the minutes beginning with zero.

Many ID timers provide only an audio and/or visual signal when eight or nine minutes have passed. Using this type of timer, the radio operator never knows how much time has elapsed until the signal sounds. I found myself identifying too often because I was never sure when the 10-minute mark would come.

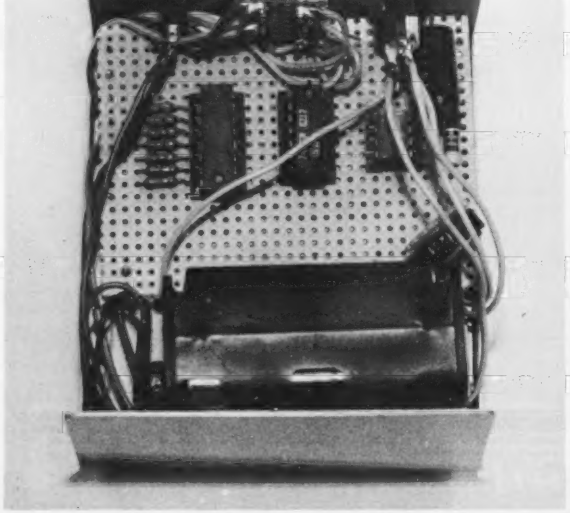

Photo A. Interior view of the timer.

Photo B. Front panel and cabinet for the ID timer.

To solve the problem, I began with a basic timing circuit using three ICs plus the seven-segment LED. I added two push-button switches, one to restart the timer after identifying and one to reset the numeral on the LED.

The 555 timer is controlled by R1, a 1-meg pot. The circuit can be set to time anything from seconds to hours. In this case, obviously, it is adjusted to provide one timing pulse per minute.

Opening S2, a normally-closed momentary-contact switch, causes the resetting pins on the 7490 to go high. This resets the LED to the numeral nine. S3, a normally-open momentary-contact switch, is then closed. This shorts R1, causing the 555 to pulse, beginning a new timing period and by the way causing the LED to pulse to zero.

After turning on the timer, operation is as simple as one-two. Simply push S2, then S3, to begin at zero. If you identify before the 10 minutes have completely elasped, simply give it the one-two again and the timer is back to zero and counting a full minute.

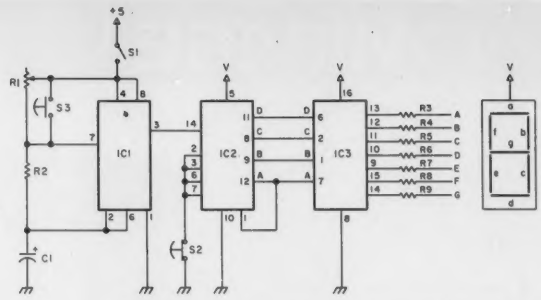

Fig. 1. The LED ID timer schematic.

Parts List	
C1	100 uF
IC1	555 timer
IC2	7490
IC3	7447
R1	1 megohm pot
R2	1k
R3-R9	330 Ohm
S1	SPST toggle
S2	normally-closed momentary
S3	normally-open momentary
LED	7-segment common anode

All parts for the LED ID timer are readily available from Radio Shack. Many parts are probably in any well-stocked junk box, but even if purchased new, the timer will cost less than $10. It can be housed in any suitable enclosure. I used a small, steel-topped cabinet because I wanted to impress my wife, but the extra expense of the cabinet is not necessary.

The circuit is extremely simple and is an ideal project for the beginner, but one note of caution is in order. I suggest the use of IC sockets for mounting the three ICs and the LED, instead of soldering them directly to the circuit board. The entire project can be assembled before the ICs are installed, reducing the risk of damaging them in the process. The sockets also allow easy replacement for troubleshooting.

My LED ID timer now sits beside my rig, faithfully ticking off the minutes and saving a lot of unnecessary callsign transmissions. Now, if I could just get my wife to stop borrowing the thing to time her daily exercises... ■

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The Secret of Remote Control

Inside those miniature planes lie some sophisticated circuits.

The Field House falls quiet as the pilot winds up the rubber-band motor of his scale model of the Porterfield Collegiate. The plane, which is made of lightweight balsa and covered with tissue paper, is held against the pull of the motor by a helper. Then, with the controls checked, the pilot gently tosses the plane toward the far end of the basketball court and steers the plane as it climbs. The pilot guides the Porterfield around the ceiling lights and basketball backboards until the motor winds down and the plane lands on the floor.

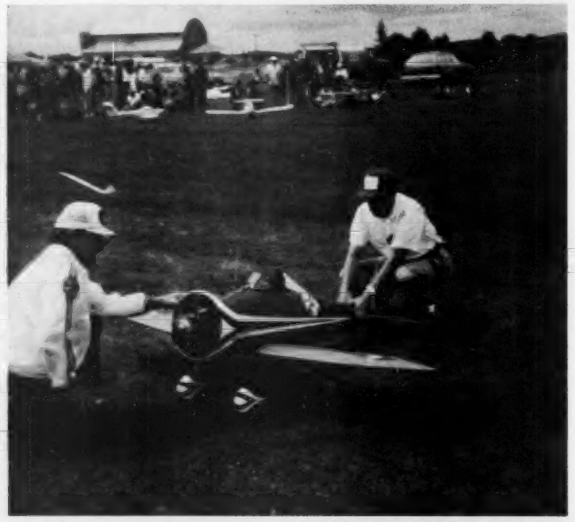
The pilot, a member of the State College, Pennsylvania, Radio Control Club, is an amateur who reworked his Heathkit® radio to reduce its size and weight to fit inside the small Porterfield. By removing the receiver case and using hearing-aid batteries and special small servos, he was able to make a flying machine small enough to fly well inside the confines of an indoor basketball court.

At the other end of the spectrum is the PennFli, an original design of a radio control (R/C) pilot from Indiana, Pennsylvania. The aircraft has a fourteen-foot wingspan and weighs over five pounds. In the warm air of summer, this plane can climb to heights of more than a quarter mile and fly over an hour without landing. It uses warm air up-drafts to stay aloft without a motor and its flight time is limited by the size of the batteries on board.

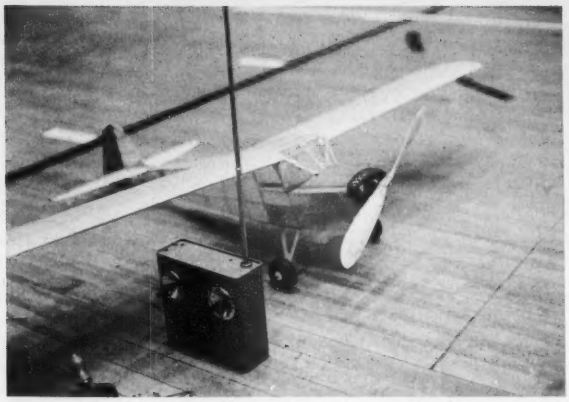
The Porterfield and the PennFli, for all their differences in size and weight, share a common guidance-system principle. It's called serial digital data transmission and it links the pilot's hands to the steering controls of the aircraft he's flying.

In Fig. 1, the scope trace shows that a timing or clock pulse initializes the sequence by turning on the decoder chain in the aircraft receiver. The next pulse in the series is a data pulse of between one and two milliseconds duration, the width of which is controlled by a joystick on the transmitter. The length of the pulse determines what position the servo arm will take. A push-rod connected between the arm and a control surface, in this case the rudder, links the servo to its workload. The receiver detects the transmitter's signal, decodes the serial data, and routes the proper pulse to each servo. In the servo, the pulse is compared to another from the onboard circuits, a function of where the servo arm is positioned. The error dif-

The PennFli, an unlimited class sailplane of fourteen-foot wingspan, weighs about five pounds. Made of balsa and plywood, the plane is covered with a plastic film which shrinks and sticks to the wood when heated with a common clothes iron. Controls are rudder, elevator, spoiler (airbrakes), and releasable tow hook.



A one-fourth full-sized model of a WWII fighter is started up. Constructed of balsa, plywood, and thin aluminum and covered with fabric, the plane uses a chain-saw engine and two-cycle mix fuel for power. A four-channel R/C rig controls ailerons, rudder, elevator, and engine speed.



The tiny Porterfield at rest. The model is made from a $5.00 free-flight kit of thin balsa strips covered with lightweight tissue paper and lightly sprayed with model paint.

A one-inch-per-foot scale model of a Porterfield Collegiate is powered up. A small hand drill and hook are used to wind up the large rubber band to full power.

ference of the two pulses is translated into action through a small dc motor similar to those used as automatic film-winders in cameras. Through a gear train, the motor moves the output arm and also a variable resistor which sets the length of the onboard pulse. When the error ratio of the two pulses is zero, the servo output arm and control surface to which it is connected are in the position called for by the pilot and transmitter. The pulse rate is fast enough so that the net effect is smooth movement of the controls and realistic maneuvering of the plane.

Were all this taking place on the ground where conditions were constant, R/C control would be a fairly simple system. By installing half the control system in an aircraft which at launch is mere inches from the transmitter, then flying the plane so high and far that it looks like a dot in the sky, using simply a length of hookup wire for an antenna, a very special receiver is needed to maintain constant control. As the radio is amplitude-modulated, static or other electrical noise could blank or change the length of one or more data pulses causing steering problems and possibly a crash. A 500-milliwatt rf signal from the transmitter is hot enough to provide solid contact out to over a mile depending on the altitude of the aircraft. The receiver is usually triple-tuned at its antenna circuit for adjacent channel rejection while a double-stage agc circuit holds the signal from the single-conversion i-f strip constant no matter how much rf is picked up by the antenna.

All this is performed by a receiver board about the size of a pack of book matches. The decoder board is the same small size and is wired to take power and audio signal output from the receiver. The long clock pulse sets the time sequence for the decoder and helps it to disregard stray noise which does not occur in the proper or expected time frame. The clock also tells the decoder which of the following data pulses are to be routed to the individual servos. The clock does not leave the decoder board while all the following data pulses are fed to their respective servos.

Most systems today are powered by nickel-cadmium rechargeable batteries in both the transmitter and the airborne unit. Airborne battery voltage is normally 4.8 volts from four 500-mAh AA-size batteries wired in series. The transmitter uses 9.6 volts from eight batteries of the same size and rating as the airborne pack. For aircraft which are ¼-size scale models of full-size planes and have six or eight controls under R/C command, D-cell-size nicad batteries are needed to handle the high net current draw. The added weight of the big pack is also helpful in balancing the model for stable flight.

While most R/C systems are factory built, Heathkit and Ace R/C, Inc., both offer full lines of radios in kit form. As mentioned earlier, the small size and high parts density of the receiver and servos make the building

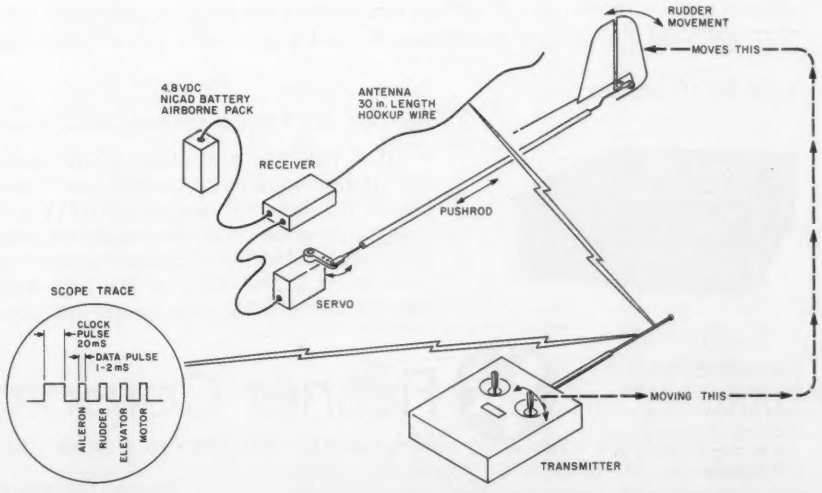


Fig. 1.

task somewhat more critical than wiring an HW-101. While it does call for some high-grade construction skills, most any amateur with some bench time will have no trouble assembling kits from either of these vendors. Both offer operating frequencies in the six-meter band where few interfering signals exist and where there is no crowding, as up in the 72-MHz CB band. While there is no mode restriction for R/C in the amateur bands, only Kraft Systems, Inc., offers an FM-type R/C rig; it is only available factory built. In high rf noise applications such as R/C model helicopters, an FM radio with its higher immunity to static would be a good choice. In most other types of models, the AM type of modulation is very reliable.

Equally as important as the system's electrical specifications is its ability to take physical punishment and be reliable. Whether the aircraft has a large or small engine, each will vibrate the R/C to some degree. If components on the receiver or servo circuit boards aren't mounted close to the board and well soldered, vibration will get them sooner or later. Even gliders, which have no engine, are battered in the landing zone as they have only thin rubber skids on the bottom of the fuselage. The quality of workmanship is very important in R/C rig construction, since almost any circuit failure would cause the plane to crash.

Once an R/C system is built, it can be modified to "fly" many different types of models. Miniature replicas of ocean-going sailboats can be raced in a pond or swimming pool using specially waterproofed gear. Even submarines which have the ability to submerge are available as R/C model kits. The hottest Formula and Indy-type race cars are built from kits and raced using two-channel radios and either electric motors or glow-type model engines. New military tank models have come out which will climb obstacles, go forward, reverse, go left and right, and swing the turret cannon. Helicopters fly in scale fashion in competition by carrying cargo or flying in formation or firing small solid-fuel rockets at targets.

By far the most popular are the scale models of World War II military aircraft. With the reliable radios available today, anyone can pilot the model of his favorite plane and enjoy the thrill of flying the old war birds.

Adapting the radio system to function in any of these models will allow the amateur to use the same rig in several models. In some cases, extra receivers and servos are built for installation in models and operated from a common transmitter so that two or more planes can be flown without having to field-change radios from one model to another.

Since there are few of us who can afford to own a Mustang fighter or a B-29 Superfort, a model of these planes is more practical. From biplanes to the space shuttle, R/C radios allow us to build and fly the most exotic flying machines safely and reliably. Imagination is the only limiting factor in choosing which model to operate, and amateur skills at the workbench make the radios as inexpensive as they are reliable. ■

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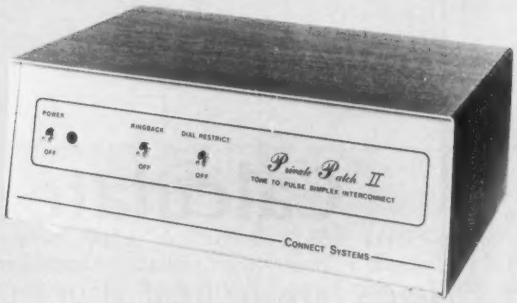

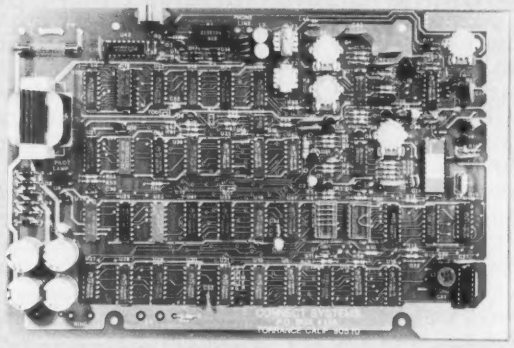

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Calculate Your FT-101

Here's how to treat your trusty FT-101 to a truly automatic digital display and get a frequency counter in the same box—at the flick of a switch.

D. N. Ellis VK8DE
57 Memorial Avenue
Alice Springs, N.T. 5750
Australia

The FT-101 series of HF transceivers has been one of the most popular in amateur radio history. One lingering criticism of the models through the "E" series, however, was the lack of a true calculating digital display. While Yaesu did offer the YO-601 digital display, it counted only the vfo and required operator adjustment for correct frequency display with any band or mode changes.

Photo A. Front view. Note that many ventilation holes were drilled oversize for more effective convection cooling of the internally-mounted LM323K voltage regulator and heat sink (photo by R. Campbell).

The "VK8DE Calculating FT-101 Display" is a "hands-off" calculating counter giving true zero-beat frequency readout on all modes and bands. It is inexpensive and straightforward to build and requires only a simple passive interface to the FT-101. It can also serve as a 50-MHz bench frequency counter, and also sports a switchable calibration output signal. The implementation used is LSTTL (Low-power Schottky), available worldwide at low cost. An accurate, automatic digital display is a necessity on the crowded bands, and this project is a convenient and economical upgrade for FT-101 owners.

The counter performs the following frequency calculation formula according to the FT-101 oscillator mixing scheme: F = bfo + LO − vfo, where F = the displayed frequency, bfo = mode-switched Beat Frequency Oscillator (LSB, USB, and

CW/AM), LO = band-switched Local Oscillator (1 crystal per band), and vfo = dial-tuned Variable Frequency Oscillator.

General Description

Reference to the block diagram of Fig. 1 will be helpful for a general description. The three oscillator signals are routed from the FT-101 external vfo octal socket (J13) on three previously unused pins through coax to the display box.

Isolation amplifiers buffer the signals and then perform a TTL level conversion for the digital processing. A crystal-referenced oscillator feeding a decade divider chain provides necessary timing for the control section. The control section directs up-down counters to follow the frequency determination formula and finally to store and display the information in 7-LED numerical displays. The FAST/SLOW switch offers the operator a choice between 80- or 800-ms-display updates with 100- and 10-Hz resolution, respectively.

The FT-101/external switch allows the unit to function as a normal frequency counter using the LO jack as the input source. The bfo-detect circuit is used to provide a preset substitute value in the absence of bfo signal, such as in AM receive mode. This feature also gives zero-beat CW frequency when the FT-101 mode switch is moved from CW to AM. The "normal" CW presentation is offset low by 800 Hz if tuned properly, which happens to be the difference between the FT-101's USB oscillator of 3.1785 MHz (used in CW receive) and the CW/AM oscillator of 3.1793 MHz (used in CW/AM transmit). A regulated +5-volt source supplies the necessary power for the counter, displays, and isolation amplifiers.

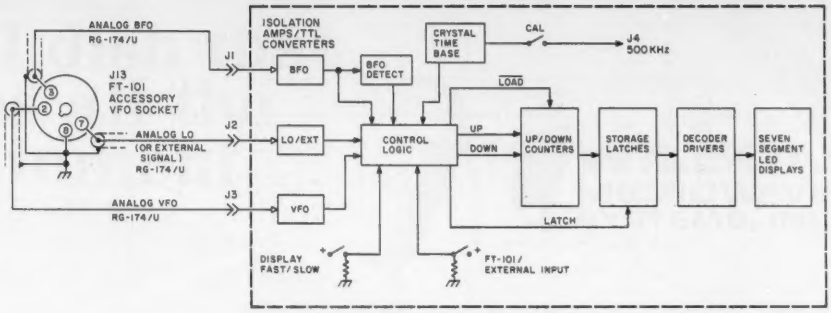

Fig. 1. Block diagram.

Circuit Details

References to the timing diagram (Fig. 2), and the four sections of the schematic (Figs. 3, 4, 5, and 6) will be made in this section. Fig. 3 shows the raw analog bfo, LO, and vfo cables routed to the BNC jacks J1, 2, and 3, respectively. With the exception of a single input resistor change in the bfo isolation amplifier, the three buffer-converters are identical. One description will, therefore, serve for the three circuits.

Because of the JFET input and the 1-megohm bias resistors, each of these amplifier's input impedance is essentially the value of the input resistor. For high sensitivity it is 1000 Ohms for the LO and vfo, and 10,000 Ohms for the bfo. These impedances do not appreciably load the oscillator signals with 1-meter connecting lengths of RG-174/U coax from the FT-101.

The JFET then feeds an NPN driver which emitter-couples via a large value capacitor to a linearly-biased 74LS04. The IC wired in this manner, as a dc-coupled multistaged amplifier, produces a TTL level (HIGH $\geq$ 2.7 V, LOW < .8 V) pulse output from the sinusoidal input. This cheap but utilitarian dc 50-MHz analog-to-TTL amplifier has been used so often by so many that it must nearly be "public domain."

Fig. 4 shows the bfo, LO, and vfo TTL signals as inputs to the timing and control section. In order to guarantee the successful use of low-cost LSTTL, the signals are each prescaled (divided) by a factor of 2. This forces the maximum LO input of 35.52 MHz (used in the 29.5–30-MHz band of the FT-101) to a value of 17.76 MHz after passing through U8, a 74S74 flip-flop.

The guaranteed specification of 30 MHz for a 74LS74 flip-flop, or for that matter, the 74LS192 up/down counters, is thereby never tested. The penalty for prescaling by two is a corresponding extension of the counting time by the same factor.

The control-section activity is directed by a four-state counter made up of U18, a 74LS74. Besides creating a specific counting interval for the bfo, LO, and vfo, the state counter provides a fourth interval to display the resultant frequency calculation and then prepare the machine for another cycle. The timing diagram of Fig. 2 shows the succession of these states and the ensuing events. The state names of 00, 10, 11, and 01 are derived from the successive logical conditions of U18 pins 5 and 9, called Q_A and Q_B. The 1-MHz crystal oscillator of U6 is divided down to provide a continuous stream of state clock pulses as shown in Fig. 2.

Three state clock pulses cause the machine to count up the bfo, count up the LO, and count down the vfo, or add, add, and subtract, in accordance with the F = bfo + LO − vfo equation. The fourth state, called 01, causes a LATCH command to store the frequency value

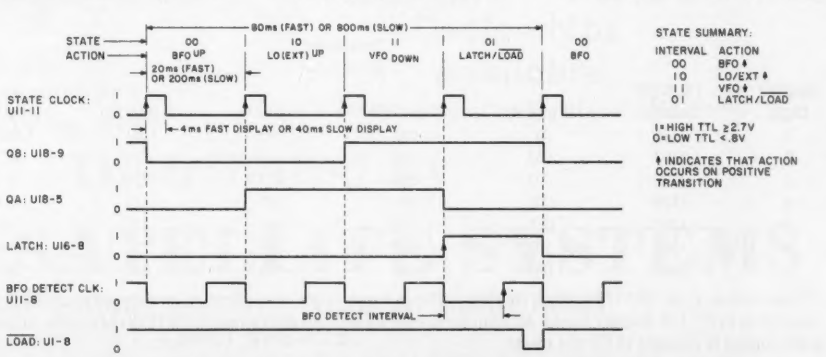

Fig. 2. Timing diagram.

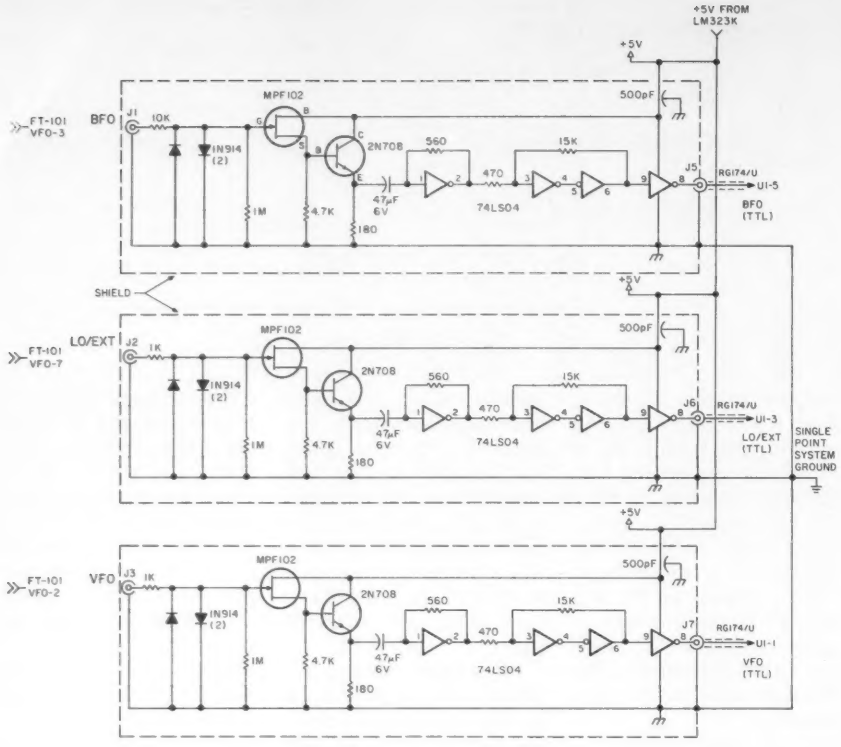

Fig. 3. Isolation amplifiers/TTL converters.

for display viewing and a LOAD pulse to prepare the 74LS192 up/down counters for the next display cycle. A bfo-detect interval is also defined that will determine whether the counter chips are to be loaded with zero or whether, in the absence of a bfo signal, the preset value of 031793 (the CW/AM oscillator frequency) is substituted for the bfo.

The two UP clock signals (bfo and LO) are multiplexed by U15, a 74LS158. The Q_A (U18-5) line selects the bfo when Q_A is a logical 0 (less than .8 volts), and the LO signal when it's a logical 1 (at least 2.7 volts). During the vfo (11) and Latch/Load (01) states, U15 is disabled, producing a solid logical 1 output. The vfo flip-flop, U9, is similarly disabled during the bfo, LO, and Latch/Load states. This action was necessary to properly condition the 74LS192 counters for up/down counting. Thus, for UP counting of the bfo and LO, the DOWN line is disabled, and during DOWN counting, the UP line is disabled.

The occurrence of the 01 state produces the LATCH command at U16-8, which stores the counter bits into 74LS175 quad flip-flops. U17 is the bfo detector, and if bfo activity was present during the bfo-detect interval, U17-8 will go to a logical 1, disabling U3. The disabled outputs of U3 will be all zeros and will be jammed into the 74LS192 counters (U22 through U28) when the LOAD pulse occurs later in the 01 interval. U17 is enabled only during the Latch interval (01 state) and, because of U10, only when the machine is in the FT-101 display mode. The extra U16 gates are used as a delay to ensure U3 output stability during activity of the LOAD signal.

The presence of two display times, together with the bfo-detection concept, was responsible for the inclusion of U3 and its strangely-named outputs. Table 1 shows how U3 (when wired as shown in the schematic) will (when no bfo signal has been detected) inject into the seven 74LS192 counters the value 0031793 when in the FAST mode (80-ms display update), and 0317930 when in the SLOW mode (800-ms update).

Fig. 4 shows the 74LS192s, the 74LS175 storage flip-flops, the 74LS247 decoder-drivers, current-limiting resistors, and common-anode right-hand decimal-point displays. The direct-drive approach was chosen to minimize the chance of display-driver RFI, which often is an unwanted result of the more efficient method of display-digit multiplexing.

Two decimal points are lit for each display mode: one to distinguish megahertz from kilohertz and one to separate kilohertz from Hertz. The FAST position illuminates decimal points on digits 5 and 2 while the SLOW setting drives digits 6 and 3. The decimal point switching and driving derive from a gate of U1 and an open collector-inverter, U2. The seven digits plus the four decimal points require 53 180-Ohm, ¼-W resistors. The displays are 8mm red 5082-7731 units, but any common-anode right-hand decimal-point displays will work.

Fig. 6 shows the power supply. An LM323K in a 15-Watt heat sink is ample for the maximum 2.1-Ampere current requirement. About 1.5 Amps is used by

		Fast/Slow* BCD Input				
Display Digit	**74LS192 Counter**	**D (pin 9)**	**C (pin 10)**	**B (pin 1)**	**A (pin 15)**	**Decimal**
7	U28	0/0	0/0	0/0	0/0	0/0
6	U27	0/0	0/0	0/1	0/1	0/3
5	U26	0/0	0/0	1/0	1/1	3/1
4	U25	0/0	0/1	0/1	1/1	1/7
3	U24	0/1	1/0	1/0	1/1	7/9
2	U23	1/0	0/0	0/1	1/1	9/3
1	U22	0/0	0/0	1/0	1/0	3/0

*Preset value: Fast: 0031793; Slow: 0317930. Above inputs are active when no bfo signal is present and counter is in FT-101 display mode. All counter-preset inputs are zero when in EXTERNAL mode, or when a bfo signal is present in FT-101 mode.

Table 1. Preset counter bit values.

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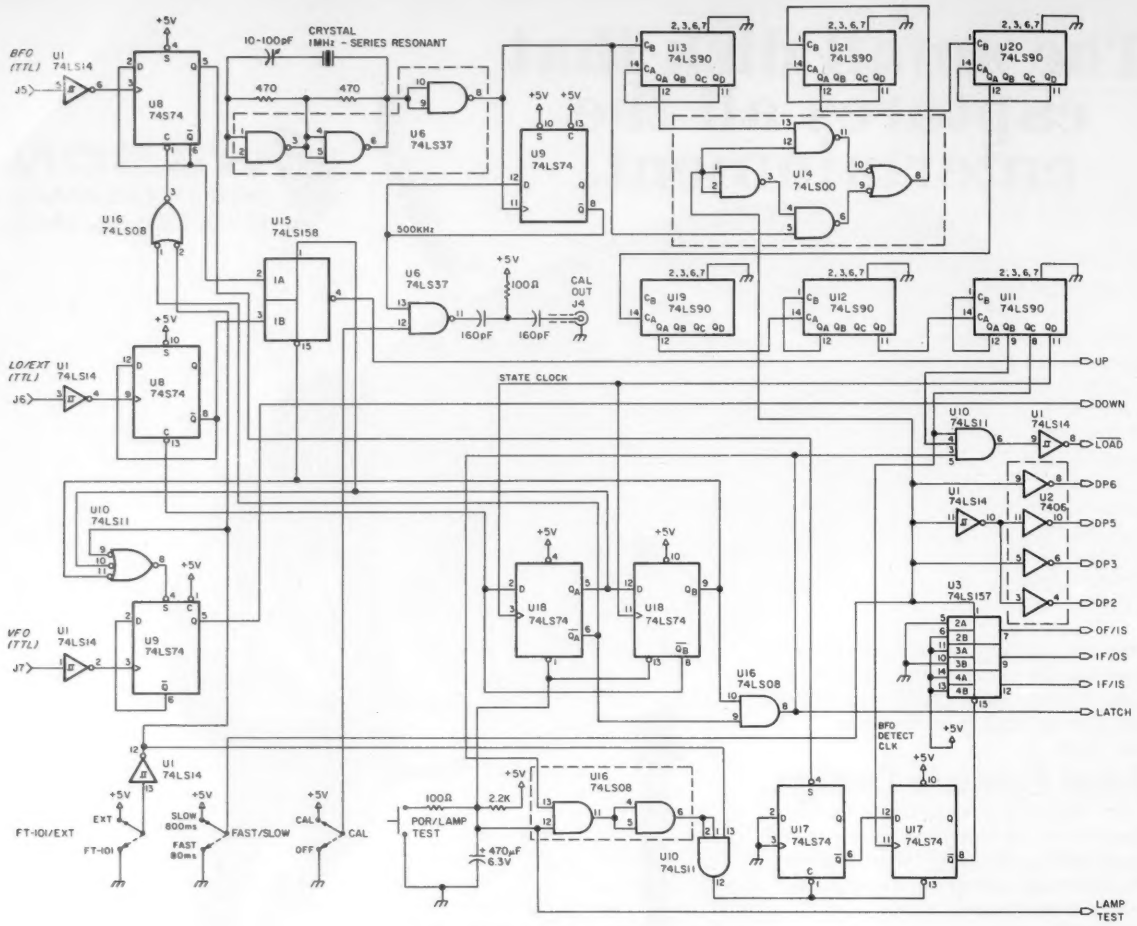

Fig. 4. Timing and control schematic.

the display during a lamp test, when all digits show eights. A 15-V center-tapped, 3-Amp transformer in a full-wave configuration was used. The ac primary is double-pole switched and fused for safety. A single-point ground system was employed to minimize the chances of ground loops.

The time base for the project is conventionally implemented from a 1-MHz TTL crystal oscillator (U6) and a cascaded string of 74LS90 decade dividers. U14 is wired as a 1-of-2 selector to change the frequency of final divider U11's outputs by a factor of 10 for the FAST/SLOW display presentation. An unused portion of U9 divides the 1-MHz oscillator signal by 2, then a remaining U6 gate buffers it and feeds a CRC differentiation network. When the CAL switch is activated, a 500-kHz harmonically rich signal is routed to the J4 output jack. This easily allows band-edge checks and frequency station-standard checks against WWV, JJY, CHU, etc.

Photo B. Rear view. Shown are the FT-101 inputs, the 500-kHz CAL output, and the operating controls. For frequency counter use, the toggle switch is set to EXT and the signal of interest connected to the LO/EXT input (photo by R. Campbell).

Construction and Checkout

The project was built in stages. The FT-101 interface was wired first. Many thanks to KH6BK (March, 1977, *QST*) for this simple but effective method of accessing the three FT-101 oscillator signals.

FT-101 interface instructions: The objective is to capacitively couple the bfo, LO, and vfo via small sections of RG-174/U coax routed through the underside of the chassis to the vfo accessory socket (J13) at pins 3, 7, and 2, respectively.

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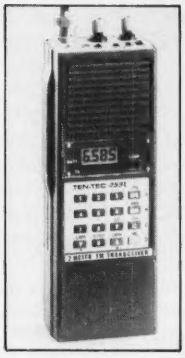

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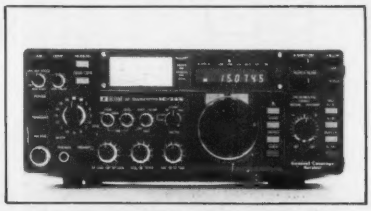

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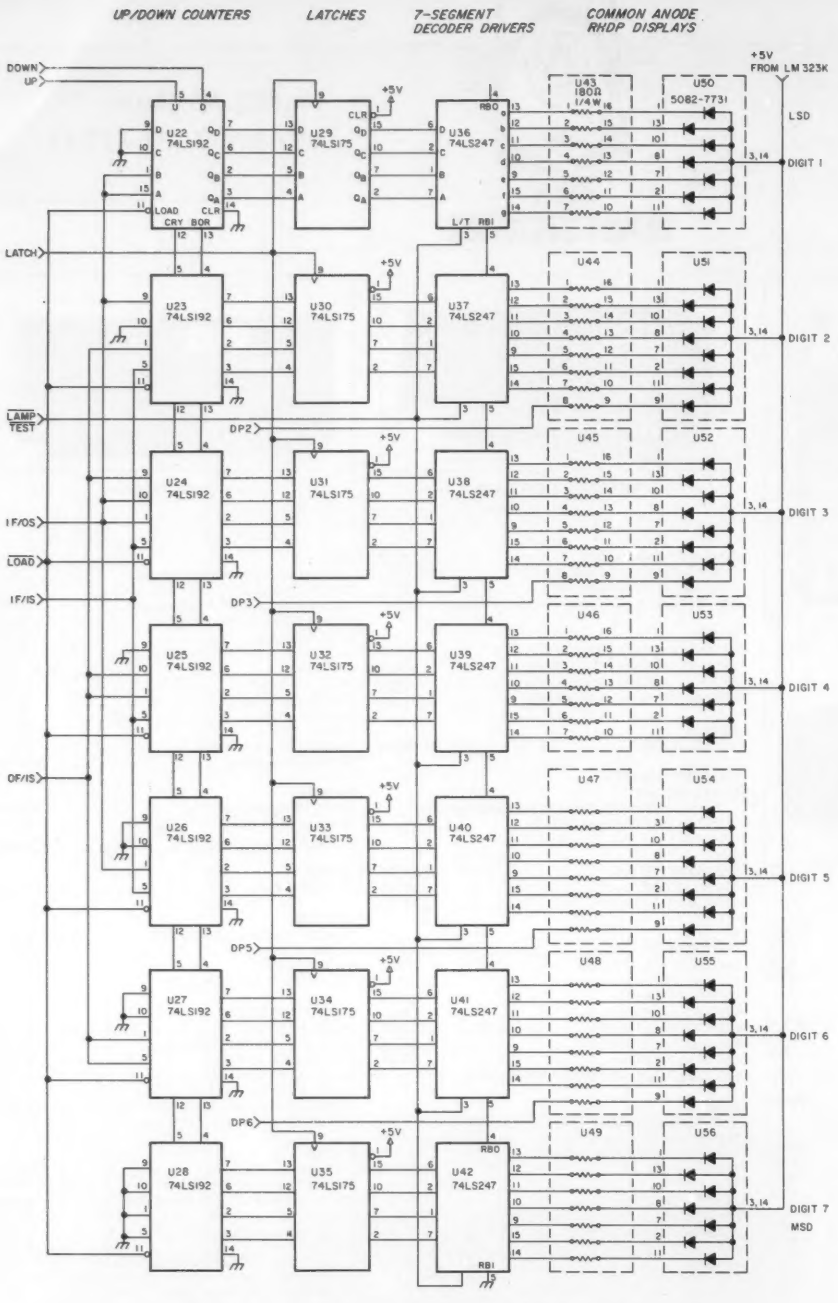

Fig. 5. Up/down counters and display schematic.

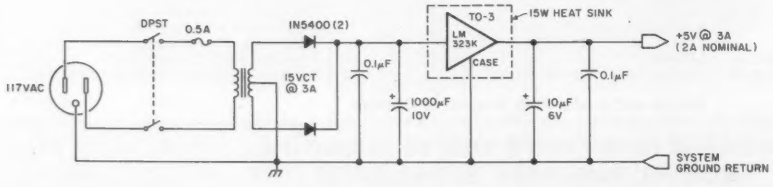

Fig. 6. Power supply.

The shields will be soldered to J13, pin 8. Dress and tin the leads for neatness.

(1)Bfo: Prepare a suitable length of coax and solder the inner conductor to one side of a .01-μF capacitor. Solder the other end of the capacitor to pin 6 of PB 1184A connector. Solder the shield to pin 7 (gnd). Route the cable to the octal vfo socket and solder the inner conductor to pin 3. Solder the shield to pin 8.

(2) LO: Prepare a length of coax and solder the inner conductor of one end directly to pin 15 of the PC connector for PB 1181A. Solder the shield to pin 18 (gnd). After routing the cable back to the vfo socket, solder the inner conductor to pin 7 and the shield to pin 8.

(3) Vfo: Prepare a length of coaxial cable. Solder the inner conductor to one end of a .01-μF capacitor. Solder the other end of the capacitor to pin 11 of the PC connector for PB 1180A (mixer). Solder the shield to pin 10. Route the cable to the vfo socket, soldering the inner conductor to pin 2 and the shield to pin 8.

(4) Remove PB 1181A. Solder a .01-μF capacitor between test point TP and pin 15. Replace PB 1181A.

The interface cable from the FT-101 to the VK8DE Calculating FT-101 Display consists of an octal plug, three equal sections of RG-174/U coax up to 1m in length, and three plugs. The plugs used in the prototype were BNC, but RCA shielded phono plugs would work. Prepare the plug ends of the cables, check for shorts, then solder the inner conductors to octal plug pins 2, 3, and 7. Label the cable to pin 2 "VFO," the pin 3 cable "BFO," and the pin 7 cable "LO," and solder the three shields to pin 8.

Plugging and unplugging the cabled octal plug at the external vfo socket will probably shift the receiver frequency a few Hertz. This is normal and merely re-

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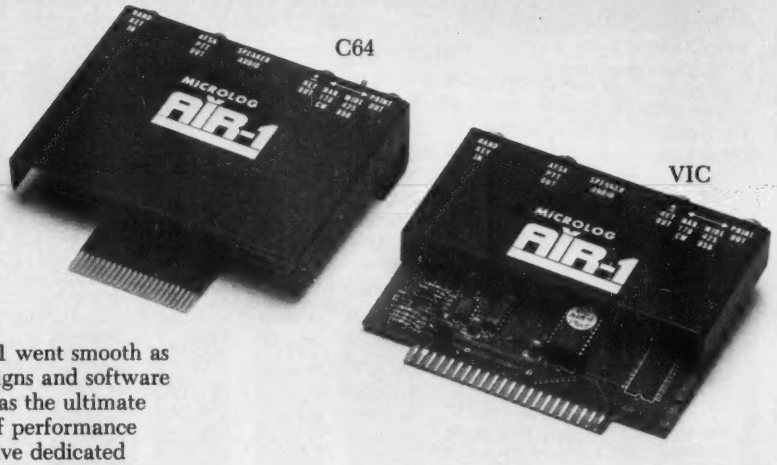

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Parts List

FT-101 Interface
- 3 .01-μF disc capacitors
- 3 45-cm pieces RG-174/U

Interface Cable
- 1 Octal plug
- 3 1m sections RG-174/U
- 3 RG-174 BNC plugs

Isolation Amplifiers
- 3 Metal boxes[1]
- 3 5 × 2.5 cm fiberglass perfboard
- 3 BNC chassis jacks
- 2 1kΩ resistors
- 1 10kΩ resistor
- 3 1 M resistors
- 3 4.7kΩ resistors
- 3 180Ω resistors
- 3 560Ω resistors
- 3 470Ω resistors
- 3 15kΩ resistors
- 6 1N914 diodes
- 3 MPF102 JFETs
- 3 2N708 NPN
- 3 47-μF, 6-V capacitors
- 3 74LS04
- 3 14-pin solder-tail IC sockets
- 3 RCA phono jacks

Counter Board
- 1 1-MHz series-resonant crystal
- 1 10-100-pF (nominal) ceramic trimmer cap
- 12 .1-μF disc ceramic caps
- 3 RCA shielded phono plugs
- 3 15 cm RG-174/U
- 1 2.2k, ¼-W resistor
- 53 180Ω, ¼-W resistors
- 2 100Ω, ¼-W resistors
- 2 470Ω, ¼-W resistors
- 2 160-pF caps
- 1 20 cm × 12 cm glass epoxy board[2]
- 31 16-pin DIP wire-wrap sockets
- 23 14-pin DIP wire-wrap sockets
- 8 16-pin DIP component carriers (headers)
- 1 74LS37
- 1 74LS157
- 1 74LS158
- 1 7406
- 1 74LS14
- 1 74S74
- 1 74LS11
- 1 74LS08
- 3 74LS74
- 6 74LS90
- 7 74LS192
- 7 74LS175
- 7 74LS247
- 7 5082-7731 red CA displays

1500 cm wire-wrap wire

Power Supply
- 1 15 V CT @ 3 A transformer
- 2 1N5400 diodes
- 1 .5-Amp fuse
- 1 fuse holder
- 1 DPST switch
- 1 1000-μF @ 25-V capacitor
- 1 10-μF @ 6-V capacitor
- 1 15-Watt TO-3 heat sink
- 1 LM323K 5-volt, 3-A regulator
- 2 .1-μF @ 50-V disc capacitors
- 1 3-wire ac cord

Chassis
- 1 LMB CO-4A cabinet
- 1 9 cm × 2 cm red display bezel
- 3 SPDT toggle switches
- 1 rubber grommet for power cord
- 1 SPDT momentary switch[3]
- 1 100Ω, ¼-W resistor

Misc.
- 4 3-cm metal standoffs
- 4 2-cm metal standoffs
- 4 1.5-cm metal standoffs

Screws, washers, bolts, wires, hand tools, solder, etc.

1. About 7.5 cm × 4.5 cm × 2 cm, similar to Bud 2100.
2. 2.54mm-spaced hole-drilled, similar to Vector 84P44WE.
3. Lamp test/power-on-reset.

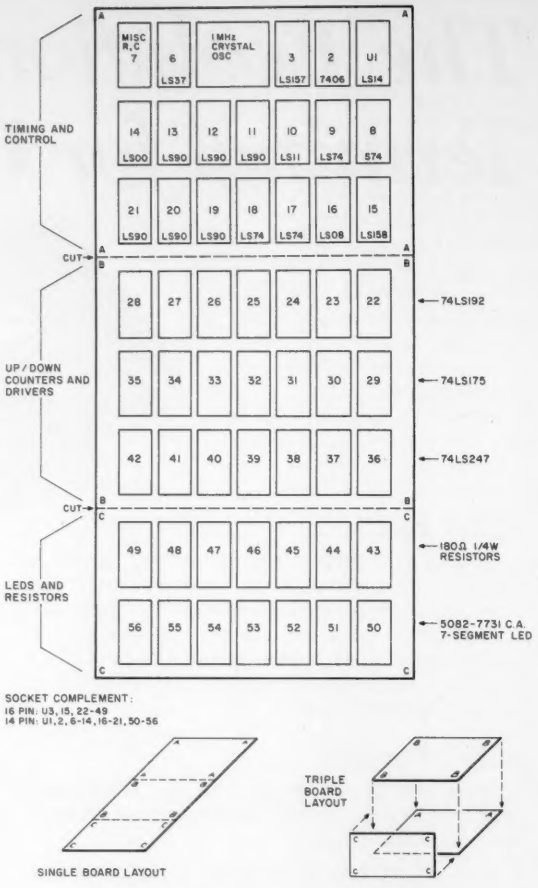

Fig. 7. Board options (component side).

flects the small change in oscillator loading.

The next step suggested is the construction of the three isolation amplifiers. Compact layout, either by printed-circuit etching or point-to-point wiring, is called for. A reasonable example layout for the amplifier from WA2FPT can be found in the September, 1982, *73*, on page 44. The three amplifiers were mounted in small metal boxes for shielding, with BNC inputs (J1, 2, and 3) and RCA phono-output jacks (J5, 6, and 7). RCA phono connectors could be used instead of BNC jacks to save a couple of dollars. The boxes were positioned at the rear of the cabinet so that J1, J2, and J3 would protrude into the enclosed compartments.

The board layout shown in Fig. 7 allows a choice of packaging. Using the single-board approach minimizes interconnections between pieces but requires a larger cabinet and right-angle sockets for the display LEDs. Cutting the larger board into three smaller sections, as shown by dotted lines, allows for a more compact chassis but more board-to-board wires. The prototype employed the three-board approach, mainly for aesthetics. Either way will work. Liberal use of .1-μF bypass capacitors is recommended—about one to every four ICs.

After the isolation amplifiers are built and working, the power supply should be built to allow checkout of the succeeding sections. Then the 1-MHz oscillator and decade divider chain can readily be wired. This prototype used wire-wrapping on a 2.54mm drilled fiberglass board (similar to the Vector 84P44WE), but it is not required. Years of home-brewing, however, point to a higher success rate with wire-wrapping despite the extra cost. Point-to-point construction would be somewhat cheaper and will definitely work but would probably require a larger layout. The choice is yours.

Power and ground wires to all ICs should be wired next. Use of a TTL data book is helpful, remembering that the wiring side is a mirror image of the component side.

The control section was wrapped next, and the timing diagram of Fig. 2 should

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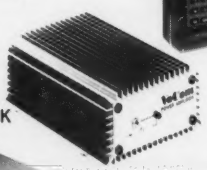

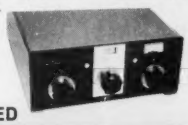

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be referenced for verification. Access to a dual-trace-triggered sweep oscilloscope would be extremely helpful if substantial troubleshooting is anticipated (or necessary!). The last section connected is circuitry from Fig. 5, consisting of the 74LS192 up/down counters, 74LS175 latches, 74LS247 decoder drivers, the 180-Ohm resistors, and the displays. The front of the prototype contains only the display bezel to emphasize the "hands-off" design concept. The FAST/SLOW switch is a long "bat handle" type on the upper-rear center panel that is easily accessed by a finger flick. For even easier access, it could as readily mount on the front, centered beneath the display.

Operational checks are made by watching the display as the FT-101 is tuned. Upon the application of power, the display will briefly flash all 8s. When displaying frequency, the last digit will be plus or minus a digit, and will change at either the 80-ms fast rate, or every 800 ms, the slow rate. The 80-ms (12.5 Hz) updates will track any tuning rate generated by human hands. Moving the FT-101/EXT switch to the EXT position with the unit cabled to the FT-101 will display the particular LO crystal-oscillator frequency.

The bfo-detect circuit is checked by noting the difference in frequency as the FT-101 is switched from CW to AM. The AM position should read about 800 Hz higher than the CW display. When the CAL signal is input into the LO/EXT jack (J2) and the EXT switch activated, the counter should read exactly .500.00 in the SLOW position, and .500.00 in the FAST position. A short wire inserted into the CAL jack (J4) and placed near the FT-101 antenna input will couple the CAL signal into the FT-101, allowing band-edge checks. The 1-MHz oscillator can be trimmed against WWV in this manner.

Although any suitable-sized, well-ventilated metal cabinet could be used to house the display counter, those in the LMB CO series of two-tone gray cabinets are particularly appealing. The prototype is housed in the CO-4A model (20×18×10cm) which required careful, dense packaging. This line of cabinetry has a convenient sub-chassis that allows all the ac wiring to lie under the sub-chassis plate. A source for LMB cabinets is Tri-Tek,Inc., 7808 N. 27th Ave., Phoenix AZ 85021.

The VK8DE Calculating FT-101 Display can be built from all-new purchased parts for about US$100. A little scavenging can reduce that figure substantially, however. Areas of cost reduction are cabinetry and point-to-point wiring to avoid wire-wrap construction.

The project was conceived, designed, and built sporadically over a two-year period, allowing for some circuit refinement, and, admittedly, for economical parts acquisition. An "as-built" parts list appears in the box. My only regret is that it was not built sooner.

A display counter such as this one is well worth the effort for the home-brewing FT-101 owner. Variations on the conventional design themes used are quite feasible and are to be encouraged for the adventurous experimenter.

As the one and two "kilobuck" price barriers are regularly burst by new HF transceivers, investing a modest sum and a little work to modernize the venerable FT-101 seems a rather attractive alternative.

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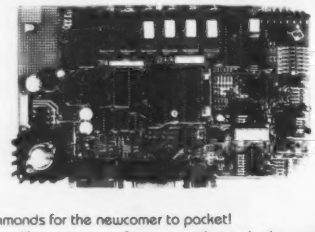

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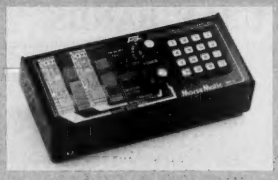

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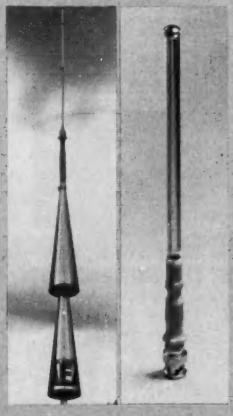

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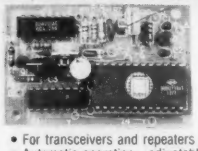

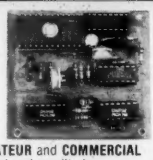

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***EX-242** FM unit	39.00	
***EX-243** Electronic keyer unit	50.00	
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***FL-52A** 500 Hz CW filter (2nd IF)	96.50	**89.95**
***FL-53A** 250 Hz CW filter (2nd IF)	96.50	**89.95**
***FL-44A** SSB filter (2nd IF)	159.00	**144.95**
SM-5 8-pin electret desk microphone	39.00	
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CF5-455K5 2.8 KHz wide SSB filter	TBA	
HM-12 Hand microphone	39.50	
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See IC-740 list above for other options (*)

IC-751 9-band Xcvr/.1-30 MHz Rcvr	$1399.00	**1229**
PS-35 Internal power supply	160.00	**144.95**
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RC-10 External frequency controller	35.00	
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Options: 720/730/740/745/751	Regular	SALE
PS-15 20A power supply	$149.00	**134.95**
EX-144 Adaptor for CF-1/PS-15	6.50	
CF-1 Cooling fan for PS-15	45.00	
PS-20 20A switching ps w/speaker	229.00	**199.95**
CC-1 Adapt. cable; HF radio/PS-20	10.00	

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Options - continued	Regular	SALE
CF-1 Cooling fan for PS-20	45.00	
EX-310 Voice synthesizer for IC-751	39.95	
SP-3 External speaker	49.50	
Speaker/Phone patch - specify radio	139.00	**129.95**
BC-10A Memory back-up	8.50	
EX-2 Relay box with marker	34.00	
AT-100 100w 8-band automatic ant tuner	349.00	**314.95**
AT-500 500w 9-band automatic ant tuner	449.00	**399.95**
MT-100 Manual antenna tuner	249.00	**224.95**
AH-1 5-band mobile ant w/tuner	289.00	**259.95**
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GC-4 World clock	99.95	**94.95**
HF linear amplifier	Regular	SALE
IC-2KL 160-15m/WARC solid state linear	1795.00	**1299**
VHF/UHF base multi-modes		
IC-251A* 2m FM/SSB/CW xcvr	$749.00	**549.95**

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IC-551D 80w 6m Xcvr	$699.00	**599.95**
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IC-451A/high 440-450 Xcvr/ps	899.00	**769.95**
AG-1 15 db preamp for IC-451A/45A	89.00	**79.95**
IC-471A 10w 430-450 SSB/CW/FM Xcvr	799.00	**719.95**
PS-25 Internal power supply	99.00	**89.95**
EX-310 Voice synthesizer	39.95	
HM-12 Hand microphone	39.50	
SM-6 Desk microphone	39.00	
VHF/UHF mobile multi-modes		
IC-290H 25w 2m SSB/FM Xcvr, TTP mic	549.00	**489.95**
IC-560 10w 6m SSB/FM/CW Xcvr	489.00	**439.95**
IC-490A 10w 430-440 SSB/FM/CW xcvr	649.00	**579.95**
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IC-22U 10w 2m FM non-digital Xcvr	299.00	**249.95**
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IC-25A 25w, 2m, grn leds, up-dn-TTP mic	359.00	**319.95**
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RP-1210 10w 1.2 GHz FM repeater	TBA	
Cabinet for RP-1210 or RP-3010	249.00	
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BP-10 Internal nicad battery pack	79.50	
BC-15 AC charger	12.50	
EX-248 FM unit	49.50	
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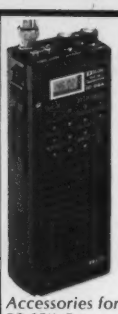
IC-402 432 MHz portable SSB xcvr	389.00	**299.95**
SP-4 Remote speaker for portables	24.95	
IC-3PS Power supply for portables	95.00	**89.95**
IC-20L 2m 3/10w PEP or FM amp	98.00	**89.95**



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IC-02A for 2 meters	$ 319.00	**289.95**
IC-02AT w/DTMF	349.00	**314.95**
IC-04A for 440 MHz	TBA	
IC-04AT w/DTMF	TBA	
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IC-2AT with TTP	269.50	**219.95**
IC-3A for 220 MHz	269.95	**234.95**
IC-3AT with TTP	299.95	**239.95**
IC-4A for 440 MHz	269.95	**234.95**
IC-4AT with TTP	299.95	**239.95**

Accessories for hand-helds	Regular
BC-25U Extra wall charger	$ 10.00
BC-30 Drop-in rapid charger	69.00
BP-2* 425ma 7.2v 1w long life battery	39.50
BP-3 Extra 250ma 8.4v 1.5w battery	29.50
BP-4 Alkaline battery case	12.50
BP-5* 425ma 10.8v 2.3w high power batt	49.50
**BC-30 required to charge BP-2/5*	
CA-2 Telescoping 2m antenna	10.00
CA-5 5/8-wave telescoping 2m ant	18.95
CP-1 Cig lighter charger (for BP-3)	9.50
DC-1 DC operation module	17.50
FA-2 Extra 2m flexible antenna	10.00
HM-9 Speaker/microphone	34.50
LC-2A Leather case without TTP cut-out	34.95
LC-2AT Leather case w/TTP cut-out	34.95
ML-1 2m 2.3w/10w amplifier (use BP-5)	**SALE 79.95**
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CA-4 Extra 440 flexible antenna	9.12
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Ever wonder how the modulation is on your FM rig? Try this simple deviation meter and find out.

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Unlike AM-SSB, FM modulation monitoring on most rigs simply is not available. It's unusual to see audio-modulated transmitters without some indicator to monitor modulation. The opposite is true of FM transceivers. The only indication that your talk power is too high is distortion at the receiving end.

The FM deviation meter I built can be used for monitoring modulation, frequency offset between transmitters, etc. Its most attractive features pay off when, in conjunction with an audio-frequency generator, the transmitter is bench-checked for equal deviation on both sides of the carrier, maximum deviation, and audio distortion.

Amateur FM uses narrowband FM, ±5 kHz maximum deviation from the carrier. The instrument can measure ±10 kHz deviation at 146.52 MHz, the common direct 2-meter frequency. An audio output with 750-μsec de-emphasis is available for scope monitoring. Most parts are available from Radio Shack, coils and variable cap were purchased from Radio Kit, and the crystal from Sentry Manufacturing.

The heart of the deviation meter is a 565 PLL FM demodulator listed as having a high linearity of demodulated output (0.2%). Calibration proved this out, better than 1% at the meter. The circuit uses the heterodyne method. A crystal-controlled local oscillator beats with the incoming signal and the resulting lower frequency FM is demodulated by the phase-locked loop. After filtering, a peak detector displays the maximum positive or negative frequency excursion of the incoming signal.

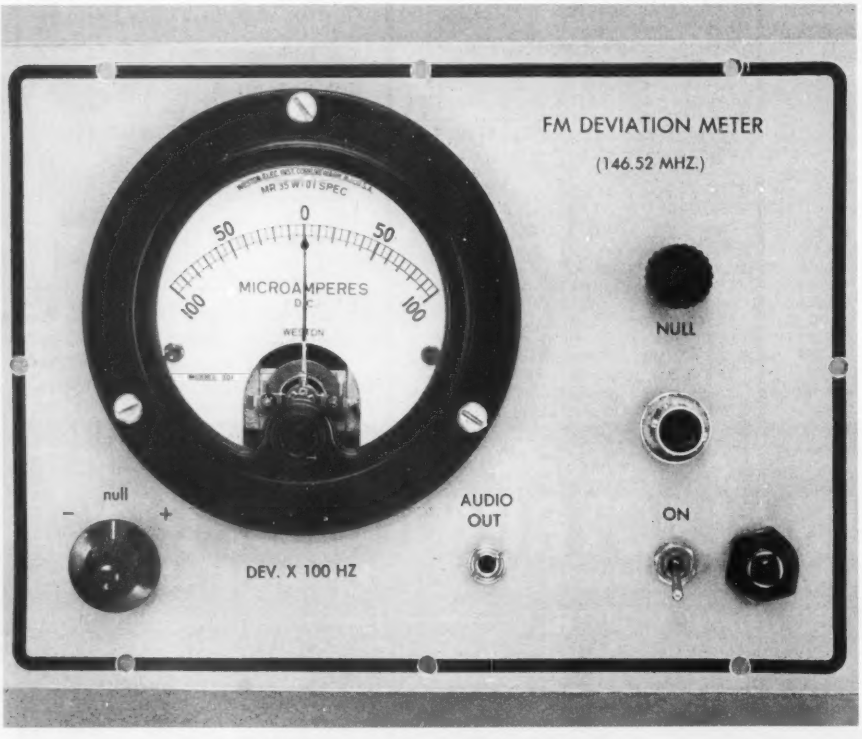

Photo A. Two-meter FM deviation meter.

How It Works

The internal frequency generator starts with FET local oscillator Q2 at 14.655 MHz. The ouput tank circuit is tuned to the 5th harmonic; it drives doubler circuit Q1. The output is thus 146.55 MHz. The incoming signal with a carrier of 146.52 MHz and the local oscillator are lightly coupled into the mixing diode, D1, resulting in a beat frequency of 30 kHz. This signal has the modulation of the incoming signal. To minimize capacitive loading of the diode, the signal first goes through high-frequency choke L5 and

then low-pass filter L6-C24. Amplifier Q3 boosts the signal approximately 10 times.

The 565 PLL has a voltage-controlled oscillator center-tuned to 30 kHz with C16-R13-R14. Basically, the incoming signal is compared with this oscillator and a dc voltage is generated which is directly proportional to the frequency of the input signal. As the input frequency shifts, it is this output signal which causes the vco to shift its frequency to match that of the input. The peak voltage occurs at peak frequency deviation.

This demodulated audio signal is available at pin 7 of IC1 and is connected to the low-pass filter and to the audio output jack through de-emphasis network R15-C21. Low-pass filter IC2a filters some 30 kHz noise generated within the PLL. The peak-detecting circuit, IC2b, charges C23 to either the positive or negative peak, selectable with switch S1. M1 essentially shows the peak voltage across C23.

The null mode of S1 is used for adjusting the difference between the unmodulated carrier and local oscillator to 30 kHz. The output voltage from the PLL at pin 7 is a dc voltage since there is no modulation. Amplifiers IC2a and IC2b works as straightforward dc amplifiers and M1 is calibrated at 30 kHz for zero reading with R16, an offset potentiometer. During use, zero adjust is made by changing the local oscillator frequency with C9, the null control.

Construction

A 7″×5″×3″ aluminum box is used for the enclosure. The oscillator is mounted on a separate board and is shielded from the rest of the circuitry. Feedthrough capacitors for power to the oscillator and the PLL input signal are used to prevent rf leakage. The shielding extends wall to wall of the enclosure; slits were filed in the box lip to let the shields slide through. Both oscillator coils were close-wound with #22 enamel wire. The top of the coil connects to the collector and the bottom end to the power supply. Tuned-circuit caps should be temperature-stable NPO discs or silver micas and are mounted at the coil with the shortest leads possible. The rest of the parts are mounted thorough the perfboard, bent over and soldered. The complete oscillator mounts on a 1.5″ x 1.75″ surface with ¾″-long spacers.

The mixing diode, D1, is mounted right behind the BNC connector. C1 reaches from the oscillator board, and L5 leads the signal to the PLL circuitry. D1 works best with a minimum of parallel capacitance. The PLL and meter circuitry together with the power supply also are mounted on perfboard. The parts are soldered to flea clips and are wired at the rear with a Vector wire pencil. All variable pots face the back for easy adjustment when the instrument is out of the enclosure. The meter is shielded from all the circuitry since rf could enter through its face.

The calculated value of the resistors used in the low-pass filter are shown on the schematic. The nearest standard value is listed in the parts list. I used a borrowed LCR bridge to select C19-C22-R18-R19-R20 to within 1% of the calculated value. If this is not possible, use standard values and check the low-pass filter for flat response with an audio generator. With 1% parts, the response curve is flat to 2 kHz, drops to approximately

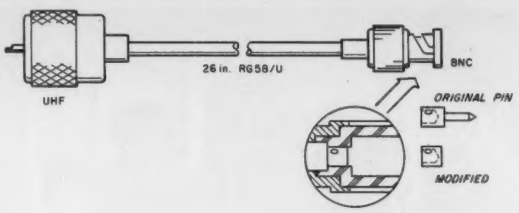

Fig. 1. Cable connectors.

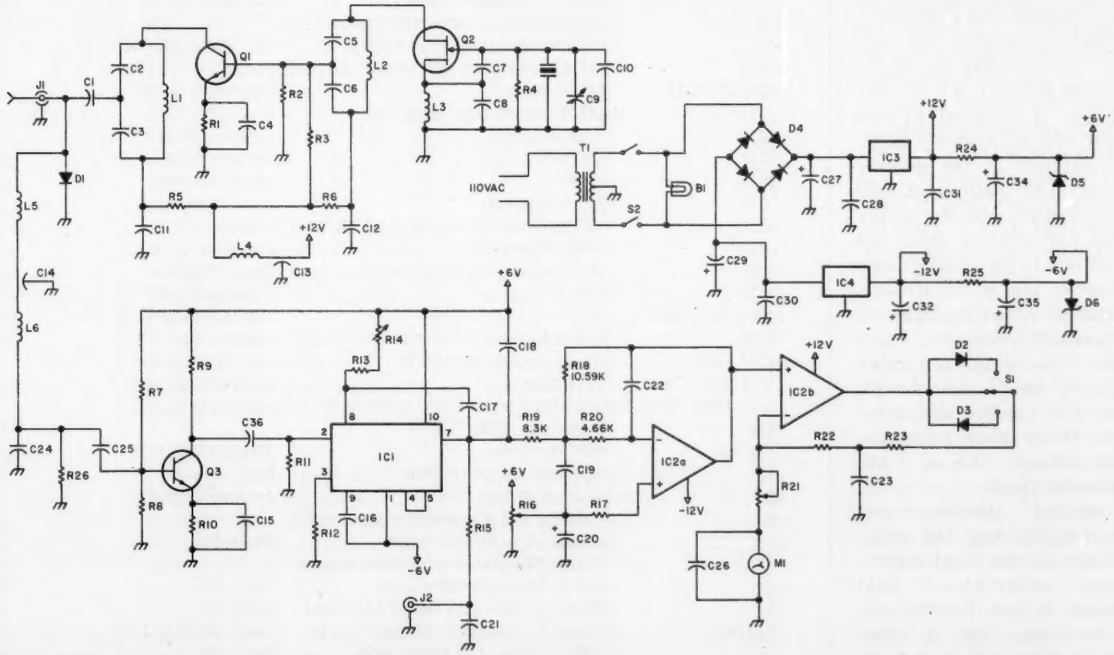

Fig. 2. Schematic.

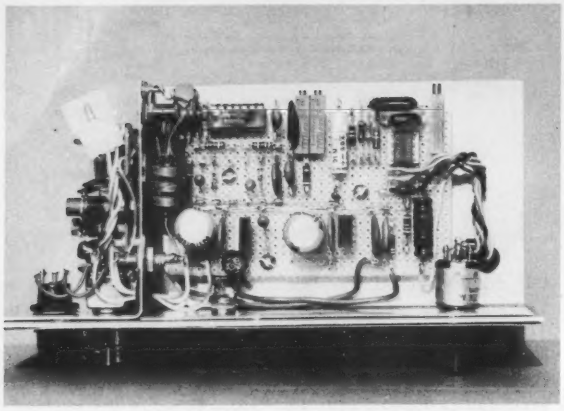

Photo B. Bottom view. Signal enters through C14 feedthrough. PLL circuitry and power supply are mounted on one board.

94% at 3 kHz, and 70% at 5 kHz. For accurate measurements of deviation, an audio tone of less than 2 kHz should be used. I used a 1.8-kHz "Sonalert" piezo-buzzer right into the microphone. These units output a clean sine-wave tone, easy for a quick test.

The power-supply transformer is mounted in the back of the box, oscillator section, and is connected with a 3-pin molex® connector. The center tap is grounded to the box at the transformer. The connecting cable is constructed from 26" of RG-58/U cable. As shown in Fig. 1, a UHF connector is soldered to one end. This will connect to the T installed at the dummy load. The instrument end has a BNC with the center pin cut short; it does not connect to the mixing diode directly but is capacitively coupled. Mounting different connectors prevents incorrect installation. The cable should be ½ wavelength since, as a stub, it affects the swr. Never connect a regular feedthrough cable as it will blow the diode.

Special attention was paid to shielding. The instrument can be used with a small antenna and held within a few feet of the transmitter. The rf noise pickup, however, is a problem and can cause unpredictable meter readings. The best way is to use a tapped dummy load with coax connections and good shielding practices.

The microammeter is a 100–0–100 movement liberated from a local surplus store for $3.50. It is an accurate movement and originally came from a General Radio instrument. An off-center scale movement can be used but extra contacts will be needed on S1 to reverse the meter.

The parts are readily available. D1 is a UHF mixer diode purchased from a local Radio-TV supply firm. The negative voltage regulator and 10-turn pots are available from mail-order electronic parts suppliers. Coils, chokes, and caps are available from Radio Kit, Box 411S, Greenville NH 03048. They have a small catalog listing radio parts which are almost impossible to obtain elsewhere. Radio Shack fills out the remainder of the parts list.

Calibration and Use

The PLL was calibrated with an audio generator monitored by a frequency counter. A 30-kHz audio tone of approximately 40-mV p-p output is fed into amplifier Q3 at R26. L6-C24 is disconnected. Pin 7, IC1 is monitored with a dc voltmeter and R14 is adjusted to a point where there is no change in voltage between the audio tone connected and disconnected. This establishes the internal vco of the PLL at 30 kHz. Switch S1 is turned to center position, or null, and R21 is adjusted at approximately the midpoint of its resistance range. M1 is now adjusted for zero, or null, with R16.

Parts List

B1	24-V power-on indicator	Fair Radio—Holder 6210-617-0934 and lamp (#327)	.78
C1	3.3-pF disc	Radio Kit	.20
C2	5 pF (May	Radio Kit	.50
C3	50 pF be	Jameco	.35
C5	15 pF disc,	Jameco	.35
C6	33 pF NPO,	Jameco	.35
C7	25 pF or	Jameco	.35
C8	100 pF silver mica)	Jameco	.35
C9	1.8–8.7-pF air variable, null control (Hammarlund MAC-10 or equiv.)	Fair Radio 228-6085	1.25
C10	5-pF disc, NPO, or silver mica (see text)	Radio Kit	.50
C4, C11, C12	500-pF disc	Jameco (3 @ .08)	.24
C13, C14	100-pF feedthrough capacitor	(2 @ .25)	.50
C16	.0022 µF	Jameco mylar™	.12
C17	1000 pF	Jameco mylar	.12
C18	.01 µF	Jameco mylar	.12
C19	.01 µF (see text)	Jameco mylar	.12
C20	1-µF, 16-V-dc tantalum or electrolytic	Jameco	.15
C22	.0022 µF (see text)	Jameco	.12
C23	10-µF non-polarized electrolytic	Radio Shack	.99
C24	.003 µF	Digi-Key M1332	.14
C15, C25, C36	.02 µF	Jameco mylar (3 @ .13)	.39
C26	.1-µF disc, mounted at meter terminals	Jameco disc	.12
C27, C29	220-µF, 25-V-dc electrolytic	Jameco (2 @ .39)	.78
C21, C28, C30, C31	.05-µF disc	Jameco (4 @ .09)	.36
C32, C34, C35	4.7-µF, 16-V-dc tantalum or electrolytic	Jameco (3 @ .15)	.45
D1	1N84 diode (ECG 112)		1.00
D2, D3	1N914 or equiv.	Jameco (2 @ .07)	.14
D4	1-A, 50-piv bridge rectifier	Radio Shack	.89
D5, D6	6-V zener diodes 1N4735	Jameco (2 @ .25)	.50
L1	4½ turns, #22 enamel wire close-wound on J.W. Miller 20A000-4 core	Radio Kit	3.30
L2	7 turns, #22 enamel wire close-wound on J.W. Miller 20A000-4 core	Radio Kit	3.30
L3	100-µH rf choke (J.W. Miller 74F104A1)	Radio Kit	1.45
L4, L5	1.72-µH rf choke (J.W. Miller RFC-144)	Radio Kit (2 @ 1.75)	3.50
L6	2-mH rf choke (J.W. Miller 4666)	Radio Kit	2.40

Vary the audio generator above and below 30 kHz and note the meter movement. An increase in frequency should show an increase in meter movement, a frequency decrease, a decrease in meter movement. If it is the reverse, interchange D2-D3 wires to S1.

Set the audio generator at 35 kHz and adjust the meter reading to 5 kHz with R21. Turning S1 to + deviation should not have any effect on the meter reading. Conversely, adjust for 25 kHz and note a negative meter reading of 5 kHz in null, or −, deviation. Slowly decrease the frequency to 20 kHz. The meter should come close to 10-kHz deviation and then suddenly return to zero. The PLL has lost control at that point.

Set the audio generator 1 kHz below the point the PLL loses control and now slowly decrease the input voltage. Again at some input level the PLL will lose control. Carefully note this voltage; it is the minimum voltage required to give full-scale indication. It could be as low as 5-mV p-p. For reliable operation, the voltage from the mixing diode, D1, should be at least four times this minimum level. I checked the meter in 1-kHz steps and found the calibration better than 1%.

Reconnect the L6-C24 filter to R26 when the calibration is completed. The local oscillator is tuned up by first turning the tuning slugs all the way in. R26 is monitored with a dc voltmeter, and L2, L1 is tuned for a peak reading of approximately ¼ volts dc. Make sure the output is the 10th harmonic or 146.55 MHz, with a wavemeter or such, and not the 11th or 9th harmonic.

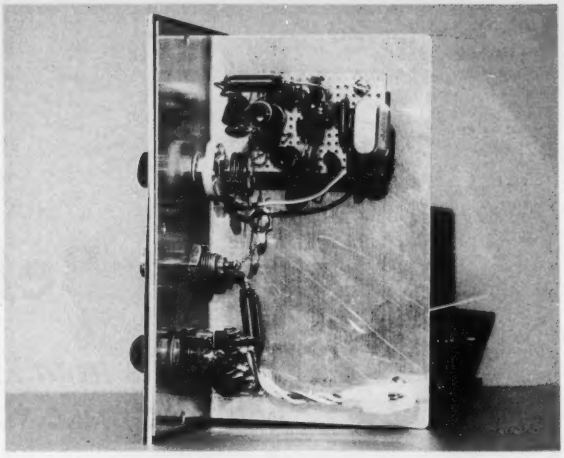

Photo C. Right side—the internal frequency generator. C1, D1, and L5 are shown connected to the BNC connector. L4 at the left top supplies power through feedthrough C13. The molex connector at the bottom connects to the transformer.

Q1	MPS 918	Radio Shack	.89
Q2	MPF 102	Digi-Key	.54
Q3	2N3904 or equiv.	Digi-Key (2 @ .20)	.40
IC1	LM565 PLL	Jameco	1.19
IC2	1458 dual 741	Jameco	.59
IC3	LM340T12	Jameco	.79
IC4	LM7912CT	Jameco	.89
R1	470-Ohm, ¼-Watt resistor, 10%	Jameco	.06
R2, R10	1k	Jameco (2 @ .06)	.12
R3, R17	10k	Jameco (2 @ .06)	.12
R4	150k	Jameco	.06
R5, R6	100	Jameco (2 @ .06)	.12
R7	33k	Jameco	.06
R8	8.2k	Jameco	.06
R9	6.8k	Jameco	.06
R11, R12, R13	4.7k	Jameco (3 @ .06)	.18
R15	15k	Jameco	.06
R22	47k	Jameco	.06
R23	100	Jameco	.06
R24, R25	390	Jameco (2 @ .06)	.12
R14	5k 10-turn pot, PLL frequency adjust	Jameco 43P	1.19
R16	5k 10-turn pot, meter null adjust	Jameco 43P	1.19
R21	20k 10-turn pot, meter calibrate adjust	Jameco 43P	1.19
R18	10k (see text)	Jameco	.06
R19	8.2k (see text)	Jameco	.06
R20	4.7k (see text)	Jameco	.06
T1	24-30-V-ac c-t transformer	Radio Shack	3.99
Xtal	14655.00-kHz crystal (parallel resonance, 32 pF)	Sentry Mfg., Chickasha OK 73018, Ref. 289590	8.00
Chassis	BUD AC-429		6.10
S1	SP-3T miniature rotary switch	Radio Shack #275-1386	1.19
S2	DPDT miniature toggle switch	Radio Shack #275-626	1.99
J1	BNC connector, chassis mount, female	Radio Shack #278-105	1.59
J2	1/8" miniature phone jack	Radio Shack #274-251	.45
M1	100-0-100-μA dc meter*	Radio Shack 0-50-μA meter	8.95

*Fair Radio lists several 0-50-μA or 0-100-μA movements. Meter-reversing switch arrangement is needed. Switch S1, Radio Shack 275-1386, can be used.

The transceiver is now connected to the dummy load with a T connector. Attach the special cable and tune the transceiver to 146.52 MHz direct. Set C9, the null control, at half capacitance. Attach a scope to resistor R26. The scope, during transmit, should display a sine wave of approximately 40-mV p-p amplitude and a frequency above 30 kHz. A value of 5 pF for C10, installed across C9, should bring the frequency to about 30 kHz. The idea is to have C9 in the middle of its operating range.

At this point, we are ready to try measuring deviation. I tested a 10-Watt unit and a 2-Watt hand-held in high and low power. With the deviation meter switched to null, push to transmit and zero the meter with the null control. Turn to + deviation and hum loudly into the microphone. The meter will show maximum positive deviation. Turn to − and repeat for negative deviation. The reading should be the same, and at 5 kHz. ■

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Prospect Heights IL 60070

Build a Better Hamfest

These hints from 25 years of experience will help make your event a success.

After over a quarter of a century of hamfest attendance as a spectator, retail exhibitor, manufacturer, and hamfest committee member, I have been asked numerous times to put down a few thoughts as to what I and other exhibitors liked and disliked. I will comment mostly from the point of view of exhibitors, as they probably have the least input to a hamfest committee.

Every committee *wants* to do the very best job, and most put in lots of effort and time with the very best of intentions. I can remember several hamfests that really bent over backwards to give the exhibitors maximum exposure to the public. We could set up all day Friday, open the exhibits Friday night, 6:00 to 10:00 pm, open Saturday, 8:00 am to 6:00 pm, have a Saturday night party, and be open on Sunday from 9:00 am to 5:00 pm.

The committees in these instances really did mean well and had good intentions, but if an exhibitor has to fly in or drive many hours Friday to set up, the last thing he needs is to open the exhibit area Friday night. He is ready to collapse for awhile and get ready for Saturday and/or Sunday. After all, he probably worked the last 5 days also. Saturday 9:00 am to 3:00 or maybe 4:00 pm is enough for one day of standing around trying to be alert and cheerful!

Several hamfests have a Saturday night cocktail party with a free bar for the first hour for the exhibitors only, then open it up for the rest of the attendees with a cash bar. This has worked quite well in most cases and is certainly a good way to show appreciation to the exhibitors. And best of all, key members of the committee can be there to get information as to what the exhibitors like and dislike about the hamfest and get suggestions of how to make next year's better.

Now here is something which could be *very* important: A few small exhibitors may have only one person in the booth and it is very difficult for them to take coffee or rest breaks. Some hamfests have local Boy or Girl Scouts or C.A.P. squadron members to help out. Such local community groups often are looking for things to do and would be happy to help man a booth and watch things for a few minutes—or go and get coffee, donuts, or a sandwich.

Some committees arrange to have coffee and donuts for the exhibitors and bring them to the booth or have it available in a central location; some even have a room where exhibitors can sit down and relax for a few minutes.

I certainly do not mean to imply that all or any committees should do all of the things mentioned here. They are things that I have observed over the years and are meant only as food for thought. And some of these ideas are more important than others. For example: It would be a very useful and desirable thing if all hamfest organizers provided some means for exhibitors to be reached in an emergency situation. A telephone situated in the display area or, at the very least, near the PA system would be one possibility. Another possibility would be a telephone located near the person who is running the radio talk-in operation. Perhaps both locations could be covered. In any case, there have been emergencies at almost all hamfests where exhibitors had to be reached quickly. Some thought should be given to this problem.

Hamfest Dates

There are times when it is difficult or impossible to coordinate your event with others on the same date. You could be locked into a date by the facilities that you use. Last year there were several hamfests that had the same dates as others that we wanted to attend as exhibitors. I am sure that situations like this will continue as it is very difficult to arrange no-conflict dates. It helps, however, if you get your date out and announced ASAP. Keep plugging this date in publications and on the air if it is a large affair that you want the big manufacturers and dealers to attend. Make sure that they know the date of the next one ASAP after the last one. Some commitments (such as ARRL national conventions) are made more than a year in advance by exhibitors.

Security is a major concern with many exhibitors, and rightly so since some have many tens of thousands of dollars worth of equipment on display. During setup times, I have observed many people walking around convention areas without benefit of any ID (committee, exhibitor, or general public). *I think this is a real no-no,* for two reasons. First, when you are trying to set up your area, the last thing you need is a distraction, especially by curious committee members or

other exhibitors who probably are not customers. They may mean well, but as I said before, an exhibitor may have left before the chickens got up that morning and perhaps drove or flew many hours before arriving for a weekend hamfest. He may also have worked the week before and maybe the last several weekends in the hamfest season.

Second, it seems that over the last few years the need for more and better security has increased drastically. I'm not sure why; maybe it's just the economy, or maybe, with our lack of ability to enforce our laws and prosecute shoplifters, more people are willing to take a chance. Anyway, could it be time to need a bill of sale on your person for your new-looking HT as you walk in and out of the exhibit area? Time for a bill of sale for *any* package, box, or equipment that you carry in and out of the exhibit area? I certainly hope not, but the Consumer Electronics Show and others have had to take this approach, with guards on the doors doing briefcase inspections, etc.

Last year I went to numerous hamfests that had equipment stolen right off displays during show hours. At the Cedar Rapids national ARRL convention last summer, a sharp-eyed and concerned attendee witnessed an HT slide off a display and into the wrong person's possession. He reported it to the exhibitor who immediately gave chase and ran the person right into the arms of a policeman. I don't know if there was a prosecution or not, but the name *and call* of the individual were known by a lot of exhibitors in very short order.

In your flyers or exhibitor packages, a map of your location with respect to the local airport, expressways, and major landmarks is certainly nice—along with approximate times and mileages from them. A list of local motels, hotels, and *nice* restaurants along with any 800 numbers and local numbers, rates, and specialty menus would make it easier for a stranger to make a choice to meet his needs or desires. Quite often, you can arrange a block of rooms, especially in a dead season, and you can really get a price break.

SAROC used to hold its convention the first week after New Year's Eve—the slowest weekend in Las Vegas—and got super room and exhibit-area rates. (Now CES has taken this time slot for the very same reasons.) So don't overlook the expensive convention areas if you can use them in their slow times; a little income for them is better than zero. But be careful of union-contract areas. The exhibit area may be inexpensive, but the electricians and dray people may turn out to be very expensive.

An absolute must for good rapport with the commercial exhibitors is a thank-you-for-coming letter sent *no later* than 30 days after the hamfest. It also gives you the excellent opportunity to include a questionnaire: How did you like the hamfest? What could stand improvement? What services or functions would you like to see added or dropped? Was there anything exc*eptionally* good or bad? Did you like the location and facilities? The list can go on and on.

If you use a form letter that requires only a check mark (✓) for yes or no and includes space for comments, you will get a better response. If you ask only for written comments, don't expect very many to answer you. Make it easy for the busy exhibitor to respond.

It is certainly appreciated when at least one person from the committee takes time and comes around once or twice, minimum, to each booth and *asks* if there is anything needed or wanted to make it a better show. Such visits should not interrupt a sale or a serious conversation. Committee members should wear some kind of ID to let exhibitors know who they are. And they should try to talk with the boss, if possible; all such good efforts might be for naught if only the hired help is seen when the boss might have something he feels is important to chat about.

Make sure, in all correspondence to exhibitors, that there is a phone number, name, and address of a responsible person who can make commitments for the event or at least will follow up with a prompt response. If you have a large event, supply a committee list of chairpersons complete with phone numbers and addresses and their responsibilities.

Booth fees at some events are negotiable, and at some they are not. Almost all hamfests need door prizes that have to come from someplace, and trading for them with booth space is probably one of the best ways to stretch a hamfest budget. I think that most dealers or manufacturers would rather trade merchandise than pay cash for a booth. There are bookkeeping problems on both sides sometimes in doing this, so play this one by ear to satisfy both sides.

In conclusion, I'd like to add that hamfests are fun for all concerned, and a little more attention to some of the details can turn a mediocre hamfest into a spectacular show . . . satisfying to exhibitors, committee members, and hams alike. I hope that some of these ideas and comments will help your hamfest become the most successful and talked-about one this year and for years to come. ■

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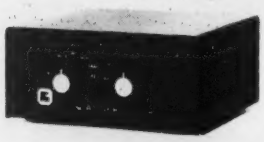

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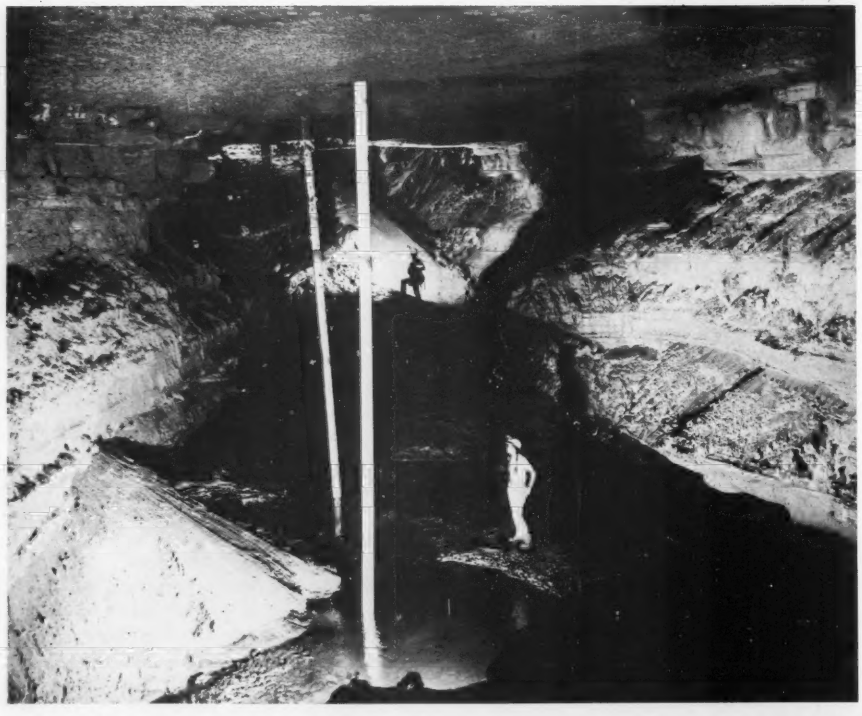

120-foot-deep wells near Park City, Kentucky, penetrated cave within two feet of radio targets. Drill drift caused error. Pipes contain hydrological instrumentation. (Photo by Samuel S. Frushour)

It's legal! Magnetic induction is not real radio—it's simply very-loosely-coupled transformer action. The FCC does not define equipment operating below 10 kHz as "radio frequency devices."

How It Works

Inductive communication is a very old technique (see "Who Really Invented Radio?—The Twisted Tale of Nathan B. Stubblefield," *73*, December, 1980). When amateur radio was banned during World War II, many hams communicated by "ground wave," i.e., magnetic induction and earth-current. ("Earth-current" is transmission of audio-frequency signals through the ground between pairs of widely-spaced ground rods connected to amplifiers.) Ranges greater than one mile were claimed.

Skin effect, which causes rf currents to travel only on the surfaces of conductors, normally prevents radio waves from penetrating ground or water more than a few feet. The depth of the "skin" increases as frequency is lowered; thus, submarines can receive transmissions from very powerful VLF stations. Experimenters have reported successful cave-to-surface communications on 160 meters. Others report positive but unpredictable results on higher frequencies.

Audio-frequency magnetic fields penetrate most geologic structures easily. There are methods for locating ore bodies, using magnetic-induction equipment as a sort of giant metal-detector (see *QST*, June, 1928).

Inductive communication is inherently short-range because magnetic dipole field strength decreases as the *cube* of the distance from the source, unlike radio waves which obey an inverse-square law. Conductive overburden will absorb the signal, but the inverse-cube attenuation is so predominant that absorption is rarely noticeable. Generating true radio (electromagnetic) waves at audio frequencies would require enormous antennas.

E. R. Roeschlein suggested using the directional properties of magnetic fields to map caves in an article in *Electronics*, September 23, 1960. Cavers, notably William Mixon and Richard Blenz, refined the equipment and developed depth-measuring techniques which are independent of signal strength (several articles appear in *Speleo Digest*, 1964).

Equipment

It's easy to get 300-foot range with very simple equipment. Longer ranges are more challenging.

A transmitter is just an audio oscillator driving an amplifier which is driving a coil. Impedance matching is important for maximum coil current. Perhaps the most important part of the transmitter is the keyer—a circuit to make it go "beep... beep... beep." In addition to the advantage of saving battery power, a pulsed signal is much easier for the receiver operator to distinguish against a background of interference than is a steady tone.

A simple resonant coil connected to an audio amplifier will work for a receiver. Use crystal earphones, because magnetic phones will cause feedback.

The circuit of Fig. 1 is a Q-multiplier. The resonant circuit is in *negative feedback* instead of being simply connected to the amplifier's input. The Q (regeneration) control taps some of the output and feeds it back to the noninverting (+) input. The amplifier forms a *negative resistance* which cancels the resistance of the coil. As the Q control is advanced, sensitivity and selectivity get higher and higher until the circuit goes into oscillation (infinite Q). Since it will oscillate, the circuit can also be used as a very-low-powered transmitter.

A 60-Hz notch filter will *not* get rid of power-line in-

WB9TLH operates underground transmitter on 3500-Hz CW, using microswitch for telegraph key.

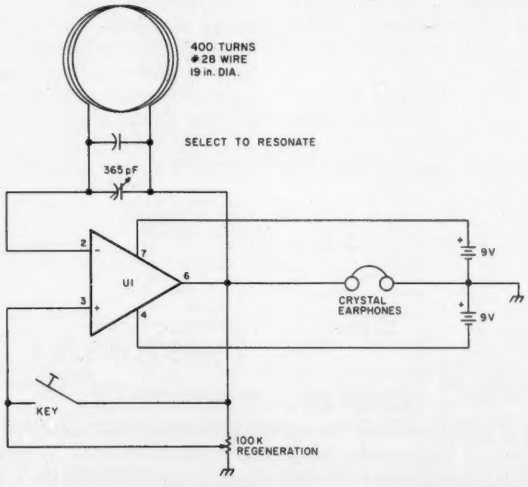

Fig. 1. One-chip transceiver uses Q-multiplier effect for high sensitivity and selectivity. Antenna needs no electrostatic shield. U1 is any 741-type op amp.

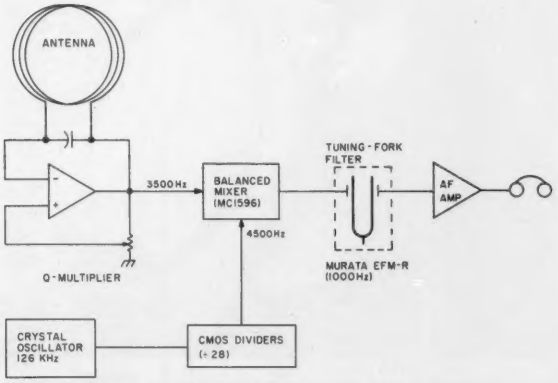

Fig. 2. Receiver with frequency conversion allows very high gain without feedback problems.

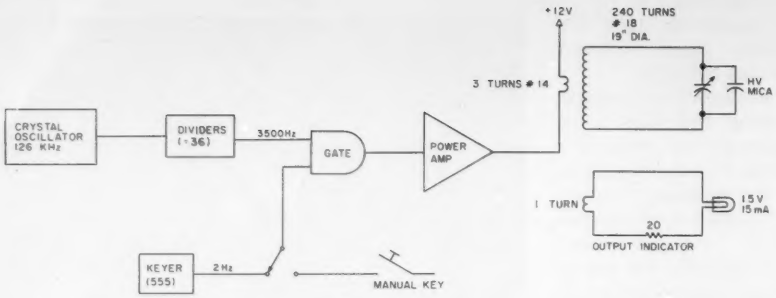

Fig. 3. A cave-radio transmitter. Precise frequency control is necessary if receiver uses very-narrow-bandwidth filters.

terference, which is not just 60 Hz but many harmonics. Don't use active filters indiscriminately. Very strong interference can *intermodulate* with the desired signal in an active filter, creating even worse interference.

Even with crystal earphones, receiver gain cannot be increased indefinitely. After a certain point, no amount of shielding and decoupling will prevent feedback. You can keep the antenna far from the amplifier, but then it's not portable. A balanced mixer and local oscillator can convert the input frequency to some other frequency, which can then be filtered and greatly amplified without feedback problems. Fig. 2 is a block diagram of one such receiver.

Interference

Power lines are the major source of interference, even in isolated areas. Harmonics of 60 Hz extend well into the ultrasonic frequencies. Power-line interference is usually directional and can be partially nulled out by the receiving antenna. To minimize interference, choose an operating frequency *in between* a pair of power-line harmonics and use a receiving filter narrow enough to reject the adjacent signals. Resonant-reed or tuning-fork filters of the type used in radio pagers can provide the necessary selectivity. Such extremely narrow bandwidths require precise frequency control and very slow CW speeds.

Atmospheric noise from distant thunderstorms can be a problem in summer. Daytime atmospheric noise is minimal around 3.5 kHz (*National Speleological Society Bulletin*, vol. 32, no. 1, January, 1970). The noise level increases appreciably after dark. Atmospheric noise is polarized such that it nulls when the receive coil is horizontal.

What's the best frequency to use? Mid-range audio frequencies work well, and the equipment is easy to build. I use 3500 Hz. 3276.8 Hz would be a good frequency because it is easy to generate from a 32.768-kHz wristwatch crystal. 3276.8 Hz falls in between harmonics of both 50- and 60-Hz power lines, and so could be used in any country. At higher frequencies, ground absorption increases and audio amplifiers become less efficient. Some experimenters have tried SSB on ultrasonic frequencies, but have found no advantages to justify the complexity of the equipment. Below 2 kHz, atmospheric noise and power-line harmonics are very strong. Subaudible frequencies below 60 Hz have been used, with very complex receiving equipment.

The OMEGA navigation system transmits very strong signals on several frequencies between 10 and 14 kHz. OMEGA stations make good beacons for testing receivers. Each station transmits for one second in a sequence that repeats every ten seconds.

Antennas

For best performance, maximize the *magnetic moment* of the coils. Magnetic moment is Ampere-turns multiplied by the coil's area.

Doubling the range of an inductive system requires an eightfold increase in magnetic moment, other factors being constant. Self-resonance limits the number of turns a coil may have. An eightfold increase in current implies either much larger wire or a 64-fold power increase. It's easy to see that

Surface location and depth of transmitter are found by null-seeking with directional antenna and by measuring shape of magnetic field.

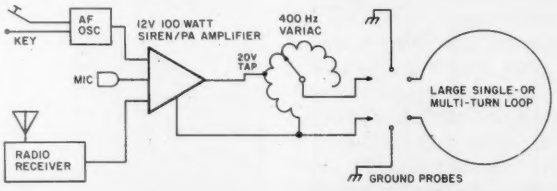

Fig. 4. Surface-to-cave transmitter uses large antenna and nigh power, so that underground equipment can be small. Surplus 400-Hz transformers are very cheap or free because there is little demand for them. (Caution—possible shock hazard between chassis and earth grounds if amplifier has no internal output transformer.)

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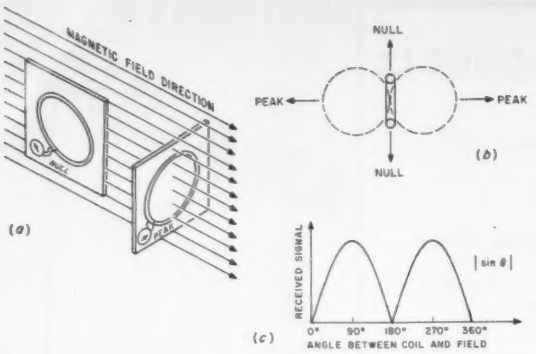

Fig. 5. (a) Received signal disappears when coil is parallel to magnetic field. (b) Note that magnetic-induction receiver coil's sensitivity pattern has null directions in the plane of the coil, unlike radio loop antennas. (c) Nulls are much sharper than peaks, but with very weak signals you may have to seek peaks instead of nulls.

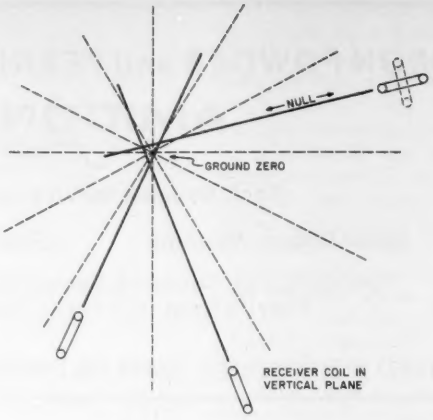

Fig. 6. Finding the approximate surface point above the transmitter (plan view).

the brute-force approach soon reaches limitations.

For a given length of wire, the optimum antenna is a single huge circular turn. Very large loops are OK for fixed locations, but coils for direction-finding must be rigid, flat, and portable. Transmitting coils must be small enough to fit through tight cave passages. In any case, the easiest route to long range is with coils of the largest manageable diameter. Build a transmitter of a few Watts, carefully match it to the coil, and concentrate the rest of your effort on a good receiver.

Ferrite-core antennas should perform well if properly designed. Ferrite cores can introduce problems of temperature instability, microphonics, and magnetic saturation. Doug DeMaw's recent book, *Ferromagnetic-Core Design and Applications Handbook*, published by Prentice-Hall, is an excellent reference.

Nathan B. Stubblefield may have discovered the interesting interaction between the magnetic-induction and earth-current modes of communication: Current injected into the ground between a pair of widely-spaced rods flows around a large underground area, creating a large magnetic moment. An inductive receiver will detect the signal. Likewise, a pair of ground probes can detect voltage induced by a distant current-carrying coil. Some cave-radio experimenters have built equipment which operates in either mode, allowing greater flexibility in varying conditions of ground conductivity.

Receiving antenna has inclinometer made from vernier radio dial and spirit-level for measuring vertical angles.

Voice Operation

My own equipment was designed primarily for direction-finding and minimum weight. It can transmit from cave to surface by CW, but it does not transceive. Two-way communication is not essential for surveying operations, but it can be very useful. (People who don't know Morse code can usually *send* it intelligibly if provided with a code list and a few minutes of instruction on lengths of dots, dashes, spaces, letter and word spacing, and abbreviations.)

For a "downlink" I use a 12-volt-operated, 100-Watt police siren/PA amplifier driving either a large loop of wire lying on the surface or a pair of ground rods. A surplus 400-Hz variable autotransformer matches the amplifier to different loads. The underground voice receiver has a ferrite-core coil connected to an audio amplifier through a high-pass LC filter which cuts off at 600 Hz, with 70 dB of rejection below 300 Hz. The filter rejects the strongest power-line harmonics. A band of voice energy called the *first formant* is lost, resulting in loss of the qualities that distinguish individuals' voices, but intelligibility remains. The female voice works best here.

Magnetic Direction-Finding

Someone must take the transmitter into the cave to the point of interest and turn it on at an appointed time. The transmit coil must be horizontal and very accurately level.

Received signal strength depends on how much magnetic flux passes through the coil. With the plane of the coil parallel to the field, no

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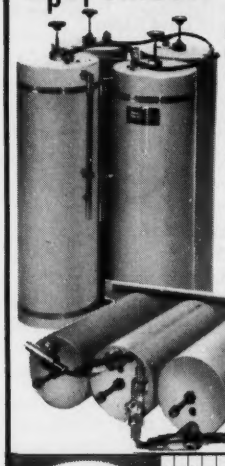

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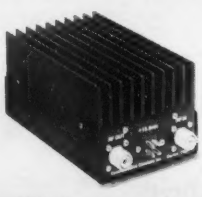

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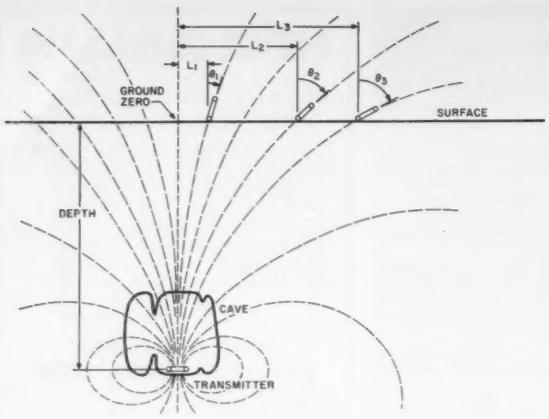

Fig. 7. Ground zero is pinpointed by finding the spot where the field is vertical. Then, distances (L) and vertical angles (Θ) are used in calculating depth of transmitter.

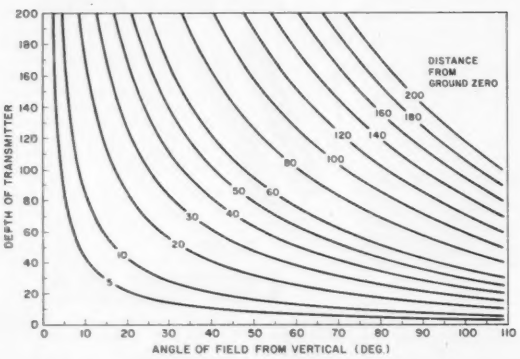

Fig. 8. Cave Radio Depth Chart (after W. Mixon). Each curve is depth vs. field angle for a different horizontal distance from ground zero. Use any distance units: feet, meters, etc. Example: For distance 50' and angle 40°, depth is 102'. Thanks to Robert F. Blakely for providing this HP-85 computer plot.

flux passes through the center and the signal disappears in a very sharp null (Fig. 5).

Viewed from above, the field of the transmit coil looks like straight lines radiating from the center (Fig. 6). The receiver operator can home in on the area of the underground transmitter by a technique similar to that of normal hidden-transmitter hunting: Hold the coil in a vertical plane and rotate to find the null direction, then "triangulate."

Once the approximate site has been found by horizontal nulls, the location can be refined to within a few inches, using vertical nulls. Fig. 7 shows a side view of the curved shape of the field. Point the coil toward maximum signal, then tilt it back and forth to find a null which indicates the direction of the field coming up out of the ground. Move in the direction of decreasing vertical angle to find a place where the null direction is straight down. Turn 90° horizontally and repeat the procedure, getting closer to the center of the field each time. "Ground zero" is the point where the vertical null is straight down, no matter what horizontal direction you point the coil's axis. An experienced operator can usually find ground zero in about ten minutes and determine depth in another ten.

CALCULATOR METHOD

Finding depth by calculator is fast, easy, eliminates plotting errors, and provides wider range than the graph. (The graph still has the advantages of low cost and easier error detection.) A programmable pocket calculator with nonvolatile memory, such as the Hewlett-Packard HP-29C, is ideal for calculating depth while on location.

HP-29C Program for Depth of Cave Radio

Equation solved for depth:

$$D = \frac{L(3+\sqrt{9+8\tan^2\Theta})}{4\tan\Theta}$$

$0° < \Theta < 90°$

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02		15	34	g DEG
03		14	54	f TAN
04			31	ENTER
05		15	63	g x^2
06			08	8
07			61	X
08			09	9
09			51	+
10		14	63	f $\sqrt{x}$
11			03	3
12			51	+
13			21	$x \gtrless y$
14			04	4
15			61	X
16			71	÷
17			61	X
18		15	12	g RTN

To use: Key in L.
ENTER
Key in Θ (in degrees).
GSB 0

Example: L = 50', Θ = 45°: Depth = 89.04'

Finding Depth

The receiver antenna should be mounted on a rigid, flat board or framework and must be equipped with some type of inclinometer, such as a carpenter's protractor. Estimate vertical angles to the nearest 1/10 degree when taking data for depth.

Mark ground zero with a stake or rock. Stretch a measuring tape horizontally away from ground zero and measure the vertical angle of the field at several different distances away. Use the distance-and-angle data in the calculator formula above or plot the data on the family of curves in Fig. 8. Average the results of several pairs of data. The depths should be consistent, falling near the average value and randomly either side of the average. An increasing or decreasing trend indicates an error in ground zero location or an unlevel transmit coil. Most of the error can be recovered by taking another set of data in the opposite direction away from ground zero and averaging the results of both sets.

Note that the slope of the depth function (Fig. 8) is very steep for small angles, i.e., a small error in measuring the angle will produce a large depth error. For best results, use only angles between 12° and 75°. (At vertical angles

near and greater than 90°, the null is less distinct and, of course, the signal is weaker at greater distances from ground zero.)

The depth chart (Fig. 8) derives from the formula: $\tan \theta = 3LD/(2D^2 - L^2)$, where: θ = angle of field (measured from vertical =0°), L = horizontal distance from ground zero, and D = depth. The formula is an approximation which assumes that the transmit coil is very small relative to depth.

Note that the closed curves of the magnetic field are ellipses, not circles. Simple triangulation cannot be used to determine depth (D = L when θ = 71.57°, not 90°). An 8 1/2" × 11" working copy of the depth chart is available from the author for an SASE.

The Future

Extending the range of underground communication makes a fine project for hams, especially VLF enthusiasts. Experiments on 1750 meters should be especially interesting.

Correlation, signal-averaging, and other sophisticated techniques for weak-signal recovery are becoming increasingly attractive to amateurs with new developments in integrated circuits. Very-long-range cave radio could, of course, be accomplished by interfacing short-range cave-to-surface links with conventional amateur radio equipment. Future technology may allow communication through the entire Earth on modulated beams of neutrinos!■

The National Speleological Society is an organization promoting safety and conservation in the sport and science of cave exploring. Their address is Cave Avenue, Huntsville, Alabama 35810.

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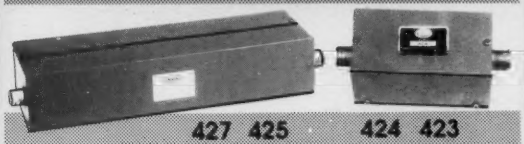

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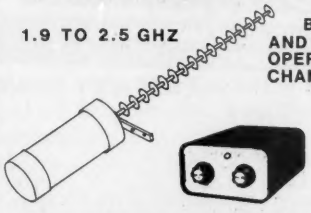

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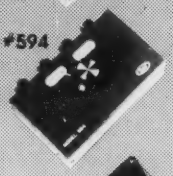

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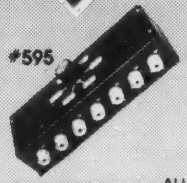

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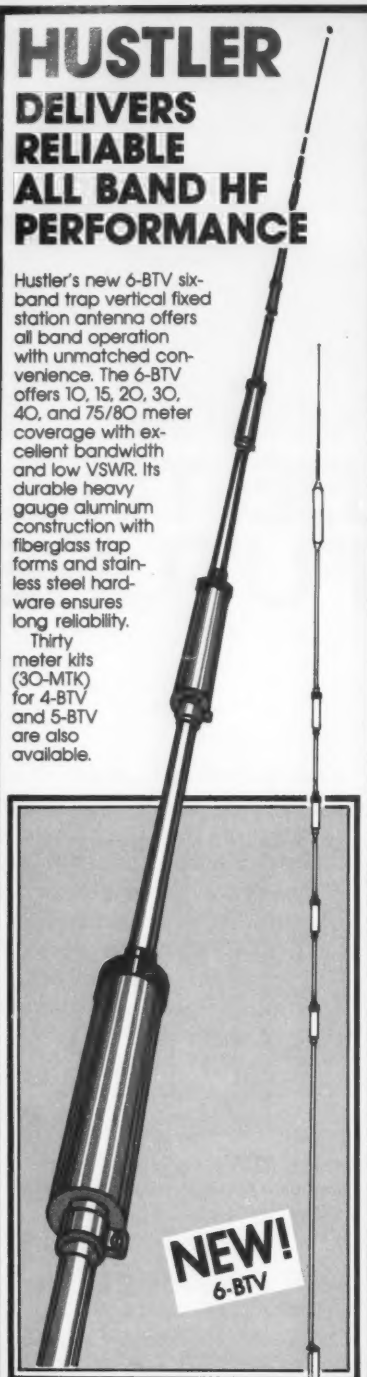

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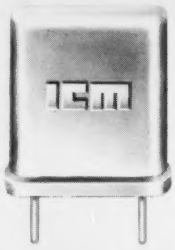

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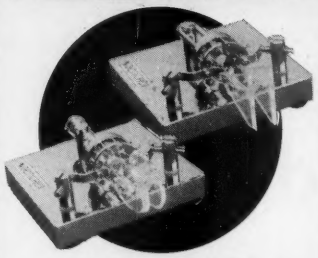

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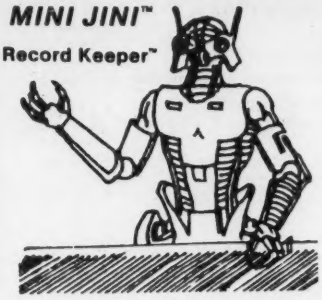

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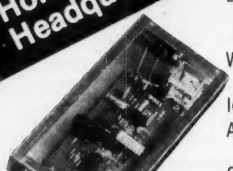

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Here's the Split-Second Timer

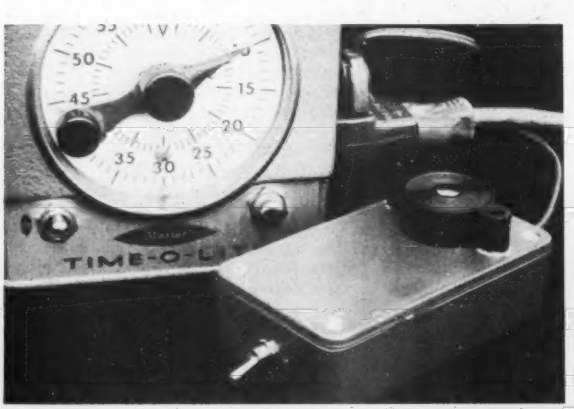
In the darkroom or the shack, this beeper has 1001 uses. Its simplicity makes it the perfect beginner's project.

Editor's Note: This article, although not exclusively amateur radio oriented, so impressed us at 73 that we are presenting it here. The author has come up with a nifty audible clock circuit. The timer could be used in a photography darkroom, as suggested by the author, or in the ham shack to time your exposure of circuit boards. The timer is simple enough to build as a first-time project. We hope you enjoy this project as much as we did.

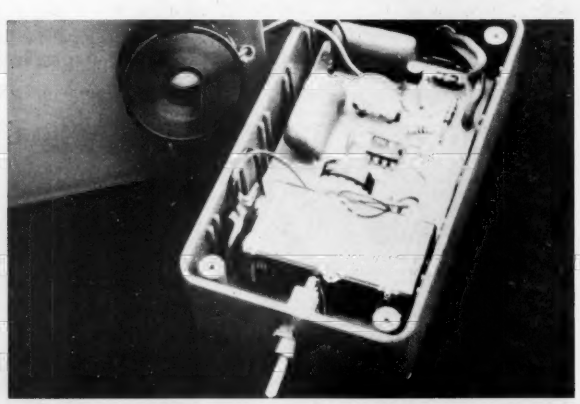
Like many hams that I've talked to, I have a second and maybe more expensive hobby—photography. Inflation has made my photo darkroom even darker with paper costs climbing to over 25 cents a sheet. Chemicals spiral upward along with paper prices while freelance jobs dwindle. The result is that I'm very money-conscious each time I open my bright yellow box of printing paper. I even scrawled "25¢ a sheet" on top of the box, but that didn't seem to cut back on the mountain of wasted paper.

With rising paper costs in mind, I decided that the cure might be a new darkroom timer. Too many prints ended up in the wastebasket because of bad dodging and burning. What I needed was a timer that would help me be more accurate, print after print. But the new digital timers cost more than I was willing to spend.

My old mechanical timer worked fine as long as I left



Here's how to interface the beeper. A cube tap is pushed into the enlarger outlet of the mechanical darkroom timer. The red wire from the cube tap goes to my photo enlarger and the brown wire to the beeper. When the timer cycles line voltage to the enlarger outlet, both the beeper and the enlarger lamp come on together.



Close-up detail of parts placement inside plastic case. The piezo buzzer is glued to the top of the case. The switch in the foreground is used to turn off the beeper while focusing under the enlarger.

it set on one particular time. The problem crept in when I needed to reset the timer to a new time to burn in part of the print. When I returned the pointer to the original time to make another print, that new print never looked the same as the first print.

Enter Bruce WA3PTU

I talked over my problem with Bruce Long WA3PTU. We reasoned that an audible beep sounding each second coupled to my present timer would permit me to set the timer for, say, 10 seconds and then never move it again. To add or subtract printing time would be easy. All I would have to do would be to count the seconds that ticked by, then block the enlarger's light path with my hand when the correct time was reached.

Dodging and burning prints could be done more accurately since I would hear the passing seconds as I worked over each print. All that was needed was an inexpensive add-on beeper (and, of course, the circuit from WA3PTU).

I built the beeper for about $11. The handful of parts came from the local Radio Shack store and fit into a plastic box. Calibration was simple using only my wristwatch. The beeper was interfaced with my darkroom timer by plugging it into a cube tap shared with my photo enlarger. The add-on beeper has made darkroom life more enjoyable and cost-efficient—so, let's build one.

How It Works

The beeper is simple. A piezo buzzer sounds each second that the enlarger lamp is on. Line voltage is also routed to the add-on beeper through a cube tap. That line voltage turns on a 2N2222 transistor switch in the beeper. The 2N2222 switches on the 555 timer circuit by grounding an internal 9-volt battery. When the mechanical darkroom timer shuts off the line voltage, the enlarger lamp and the beeper turn off, for practical purposes, simultaneously.

Part of the 555 timer circuit was borrowed from Don Lancaster's *TTL Cookbook*.[1] I won't repeat Lancaster's very complete description of why the circuit works. All that's necessary is to note that the combination of R1 and C1 produces a beep about .1 second long. The 5k pot adjusts the beep's volume.

The 500k pot calibrates the timing cycle. This pot is carefully adjusted until 61 beeps are timed in 60 seconds. That's right, 61 beeps. When the enlarger lamp and the beeper are first turned on, a beep sounds. That's the extra beep. I really wasn't sure that I could live with that first beep coinciding with the enlarger lamp turning on. Now, after 7 months of use, I expect that first beep and compensate for it. Look at it this way: When you have 20 identical prints to make of the family reunion, it doesn't matter if you remember 5 beeps or 6 beeps as the time for burning in Aunt Lydia's face. What counts is that you consistently give her face that same extra exposure on each of the 20 prints if you don't want to waste paper. Whether or not you count that extra first beep is your decision.

Building the Beeper

Now let's build the beeper. My beeper shown in the photos was built on a printed circuit board. However, a 2"×2" square of perfboard or an etched and drilled Radio Shack IC board, catalogue number 276-024, makes construction simple. The important thing is to make certain that you

[1] *TTL Cookbook*, Don Lancaster, Howard W. Sams and Co., p. 174.

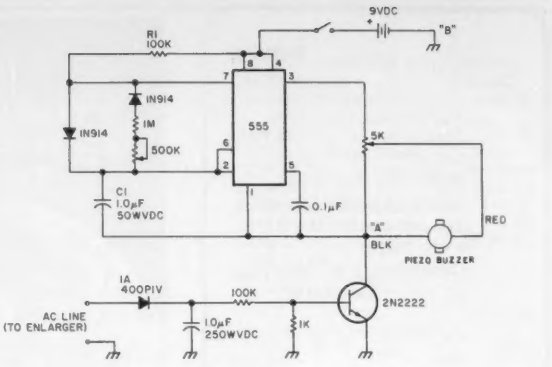


Fig. 1. Add-on beeper schematic.

assemble the parts in an *all plastic* box. That's a plastic box with a plastic panel. Do *not* substitute any of the multitude of boxes available with aluminum panels. The 110-volt-ac line is quite safe as long as it remains isolated inside the case. Aluminum panels could provide a dangerous path outside the box.

The circuit board and battery are friction-fit inside my case. Don't use metal screws to fasten the board to the box because of the shock hazard. Instead, glue the battery and board to the case with a few well-placed dabs of silicone rubber cement.

A word about parts. No, I don't manage a Radio Shack store or have stock in Tandy Corporation. The parts list has Radio Shack catalog numbers to help beginning builders. I'm certain that these commonly available parts can be found in most any ham junk box. Parts layout isn't critical, either. Observe the polarity of the piezo buzzer. The schematic is marked to show placement of the red and black leads.

Operation

I included a switch to turn off the beeper while focusing or composing under the enlarger. When you are ready to make that first print, turn on the beeper. Set the mechanical darkroom timer for your average printing time. I've standardized on 10 seconds. Never move the mechanical timer off the time you selected—in my case, 10 seconds. If you have a dense negative and must burn in parts of the print, simply press the mechanical timer's button again for another 10-second cycle and count off the extra time. You will probably find that the old mechanical timers are sufficiently accurate when used this way. Inaccuracies creep in when changing the time setting back and forth. For this reason it is much more accurate to set the timer and print as I described than it is to print for 10 seconds then reset the timer for another 5 seconds to burn in part of the print. Consistent dodging can be done by counting the beeps as you hold back underexposed parts of the negative.

Consistency and repeatability result from using the beeper and the "hands-off-the-timer" method. If you don't believe me now, wait until you finish that print order of 20 reunion pictures. Aunt Lydia will look the same on each print—guaranteed.

An Extra Added Bonus

Now that you've built the add-on beeper and love it, let's take it out of the darkroom. Remember that picture you tried to take last December of the Christmas tree and lights after dark in

Parts List

Quantity		Cat. No.	Price
1	Plastic box, 4" × 2-7/16" × 1-1/16" (Note: Box must be all plastic to isolate line voltage and prevent shock.)	270-221	$1.89
1	Piezo buzzer	273-060	2.99
2	Capacitors, 1 uF, 250 WV dc, mylar™ metal film	272-1055 ($.89 ea.)	1.78
1	Capacitor, .1 uF, 50 WV, disc	272-135	.79
1	Potentiometer, 500k	271-221	.59
1	Potentiometer, 5k	271-217	.59
2	Resistors, 100k, ¼ Watt, 5%	271-1347	.16
1	Resistor, 1k, ¼ Watt, 5%	271-1321	.08
1	Resistor, 1 meg, ¼ Watt, 5%	271-1356	.08
2	Diodes, silicon switching 1N914	276-1122	.20
1	Diode, 1 Amp, 400 piv	276-1103	.69
1	Timer IC, 555	276-1723	.99
1	Transistor, 2N2222	276-2009	.79
		Total	$11.62

Catalog numbers from 1982 Radio Shack Catalog No. 354.

the front yard? The Kodak *Professional Photoguide* suggests that with ASA 64 film and your camera lens set at f/8, a starting exposure is 5 seconds. Now, you could count "one-one-thousand, two-one-thousand . . ." or you could build a *second* add-on beeper to time that long exposure.

All you need is a PC cord to interface the beeper with your camera. Build another beeper *without* the ac line cord and transistor switching circuit. Cut off the end of the PC cord that mates with a flash unit and solder one PC cord wire to point A on the schematic and the other PC wire to point B. Plug the PC cord into the camera, set the shutter to Bulb, and hold open the shutter for an audible 5 seconds or 6 beeps.

Bracketing is just as easy as counting more or less beeps either side of the recommended starting exposure. Think you can count 5 seconds pretty accurately to yourself in your head? Well, the beeper might come in handy when making a picture of, let's see, a "moonlit snowscape." According to the *Professional Photoguide*, that's about 70 seconds at f/4, with Kodachrome 64 film.

Hmmm . . . Now if I want to bracket, that's 140 seconds and 35 seconds, but then I have to take into account reciprocity failure, so . . . Or was that 141 beeps and 36 beeps? Anyway, the important thing is to build a second beeper without line cord and interface it with your camera. That way there won't be any shock hazard.

The circuit is simple but the beeper works quite well. Build one and stop filling your darkroom wastebasket with printing paper. Instead, start thinking about where you're going to put that new tribander with all the money you save. ■

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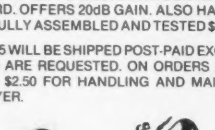

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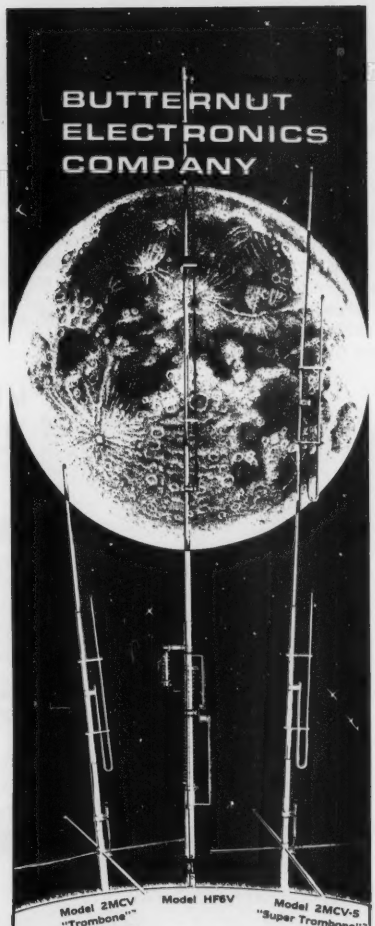

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6 position antenna switch on front panel, 12 position air-wound inductor; coax connectors, binding posts, black and beige case. 10 x 3 x 7 in.

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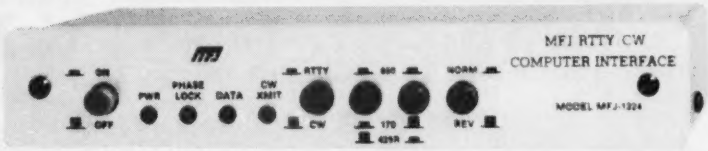

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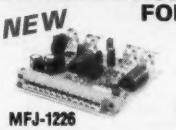

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Bill Cikas
1627 Paradise Boulevard
Rockford IL 61103

Peak Your Picture With Home-Brew SSTV Test Gear

Go from gray scale to color bars with these simple generators. No monitor should be without them.

In my spare time I enjoy viewing slow-scan television on my home-brew monitor and like to keep up to date with advances in this field. Also, I enjoy designing with all types of integrated circuits, CMOS in particular. Thus, I have combined these two interests into the two projects described here. Each generator has nine ICs and few other components and both can be built for well under $100.

The SSTV gray-scale generator is used as a standard to adjust brightness and contrast levels on commercial slow-scan monitors and to peak sync and bandpass filters on home-brew equipment. It also can be used to check repairs or modifications on any monitor.

In addition to the above-mentioned operations, the SSTV color-bar generator is useful when selecting red, green, and blue filters for color slow-scan photography. It provides a pattern with these colors plus mixtures of them into blue-green, violet, yellow, and white.

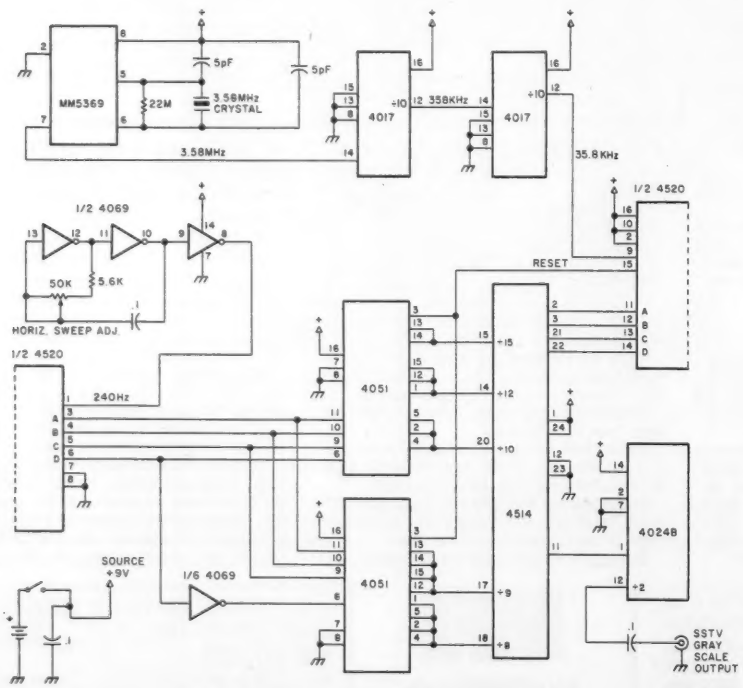

Fig. 1. CMOS SSTV gray-scale generator.

Gray-Scale Generator

The MM5369 is a crystal-controlled oscillator providing a square wave at 3.58 MHz. This signal is divided by a factor of 10 through each of the 4017 dividers. A 35.8-kHz signal is present on pin 9 of the 4520 binary divider. A binary code is fed into the 4514 decoder.

Meanwhile, the 4069 clock provides a 240-Hz square wave to pin 1 of the other binary divider in the 4520 package. Here, the binary-coded output selects one of the 16 available input pins from the two 4051 digital selectors and passes reset information from the 4514 decoder through pin 3 of both 4051 ICs to the reset pin (pin 15) of the first binary divider.

As the 16 input pins are swept through (top to bottom on the schematic), the 35.8-kHz frequency is divided by factors of 15, 12, 10, 9, and 8 respectively. This will constitute one scan line on the monitor. The 4024B takes frequencies from the "0" pin (pin 11) of the 4514 and divides all by a factor of two. The result is an SSTV gray scale with frequencies within one percent of 1200, 1500, 1800, 2000, and 2250 Hz. All are 50/50 duty-cycle square waves so gray-scale shades will result only from changes in frequency. The only adjustment necessary is horizontal sweep speed.

Color Bars for SSTV

The same general operation of the gray-scale generator can be redesigned to give us the three frame patterns necessary to produce, photographically, a slow-scan color-bar frame.

We start again with a 3.58-MHz oscillator and divide by a factor of 100, this time in a single 4518. A 35.8-kHz signal is fed to pin 9 of the 4520 and a binary-coded output is available at the address inputs of the 4514. Also, a clock frequency of 120 Hz is provided at pin 1 of the 4520 and a binary code is presented to a single 4051.

The action of the 4051 and the two sections of the 4053 can be described as switches in series. Binary data on address pins 9, 10, and 11 of the 4051 and control pins 9 and 10 of the 4053 will route data from the 4514 pins 15, 14, and 18 to pin 15 of the 4520. The timing of these connections will produce horizontal and vertical pulses as well as full cutoff and saturation (black and white) bars when viewed on the monitor. When looking at the three frame patterns, one can see a relationship forming between the width of the bars and the square-wave frequency at the RGB select switch.

A 555 timer is used as a 98/2 duty-cycle clock to control pin 10 of the 4053. This clock and the bottom 4053 switch provide a vertical sync option for the generator. For about two scan lines worth of time, the generator will produce a 1200-Hz tone. The monitor will look at this tone as a vertical sync pulse.

The 4013 is a divide-by-two stage that operates identically to the 4024B in the gray-scale generator. The output inverter is not necessary if one has a "B" series 4013 device.

Going Further

The heart of these audio-tone generators can be a good starting point for other projects. Add a memory (ROM) and send graphics or your call letters without a computer. Build a flying spot scanner, vidicon camera, or a totally solid-state SSTV camera with the new Reticon photodiode arrays (see *Radio Electronics*, March, 1982, page 75). ■

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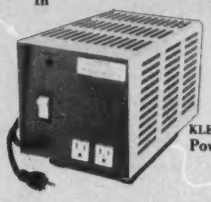

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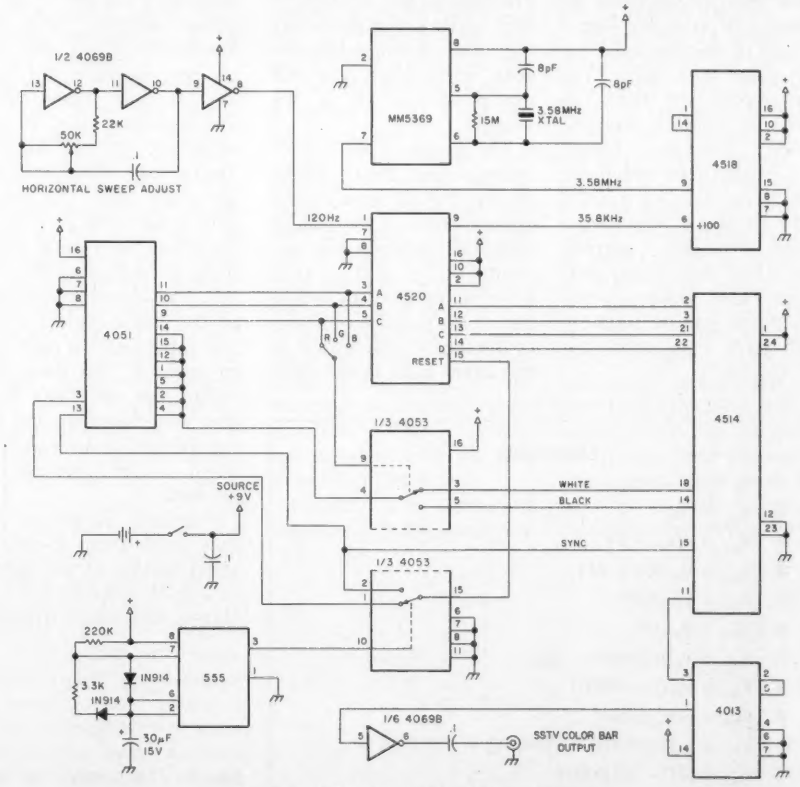

Fig. 2. CMOS SSTV color-bar generator.

✓ See List of Advertisers on page 98

Bob Myers KCØEW
729 Dawn Avenue
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Op Art

Include the ubiquitous op amp in your next circuit. KCØEW tells how.

When the Linear IC Hall of Fame is established, it's a pretty safe bet that among the first to be inducted will be the operational amplifier, or op amp. From the venerable 709 and 741 to the latest wideband wonders, this class of component has found its way into more circuits than practically any other chip.

The op-amp IC has made possible designs that would have been prohibitively expensive or complex just a couple of decades ago. You can filter with them. You can amplify with them. You can add, subtract, multiply, divide, integrate, buffer, mix, and oscillate with them. And if you can learn just a little bit about how to use these versatile gizmos, you'll find that design challenges that looked almost impossible can be simple—with some imaginative use of "Op Art."

Simply put, an operational amplifier is just a very high gain voltage amp with high input impedance and practically no output impedance. A typical op amp will show a voltage gain of several hundred thousand, with an input impedance in the megohms.

On a schematic they're not much to look at—Fig. 1 shows the ubiquitous triangle symbol of the op amp. The inputs are marked + and −, denoting the inverting and non-inverting inputs, respectively. The output is at the tip of the triangle.

The op amp is really a differential-input device, meaning that the output is an amplified version of the voltage *difference* between the two inputs; the + and − symbols merely give an indication of the polarity, or phase, of the output with respect to the input. Both inputs must be used for the output to do anything meaningful.

So we've got a part which will amplify a voltage by a hundred thousand times or more. Seems like just the thing for a stage with lots of gain, right? Just think, we'll feed the input a few millivolts (maybe from that turntable over there) and drive our speakers directly from the output!

Well, not quite. The op amp isn't meant to be a power amplifier, and that hundred-thousand gain simply isn't usable in this fashion. This gain figure, called the *open-loop* gain, is very important but not like this. The op amp, or any other single stage with this much gain, tends to be very unstable when run without something to keep it under control. That doesn't mean that all this gain is useless; we've just got to find the right way to apply it. The thing that makes the op amp's huge gain very desirable (and the key to most op amp applications) is the principle of *feedback*.

Feedback simply means that we're going to take a small portion of the output of a given stage (or series of stages) and return it to the input. Feedback can cause an otherwise stable circuit to suddenly go into violent oscillation—as anyone who's ever spent some time with PA systems knows! The squealing heard when a microphone is placed too close to the speaker it's driving is an example of *positive* feedback—the output signal is returned in-phase with the input, adding to it and driving the system farther and farther into oscillation. But if you return the output so that it is out of phase with the input, in *negative* feedback, you can actually improve the stability of the circuit. Here's how it works.

Consider the simple block diagram shown in Fig. 2. The triangle here is used to indicate some amplifier (not necessarily an op amp) with a voltage gain of A. This means that the output voltage is A times as big as the input voltage (V_{in}). V_{in} is applied to the amplifier so that it appears as the voltage *difference* between the two input leads, so we're still talking about a differential amplifier.

So far, no big deal, right? But suppose we add a block which returns a part of the output back to the input, as

EQUATIONS

1. $V_a = V_{in} - FV_{out}$
2. $V_{out} = AV_a$
3. $V_{out} = A(V_{in} - FV_{out})$
4. $V_{out} = V_{in}(A/1 + AF)$
5. $V_{out} = V_{in}(A/AF)$
6. $V_{out} = V_{in}(1/F)$
7. $V_{out} = V_{in}[1/(R1/(R1 + R2))]$
8. $V_{out} = V_{in}(1 + R2/R1)$
9. $V_{out} = -V_{in}(R2/R1)$
10. $V_{out} = -[V1(RF/R1) + V2(RF/R2) + V3(RF/R3) + \ldots]$
11. $V_{out} = (V1 - V2)(R2/R1)$

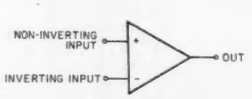


Fig. 1. The symbol for the op amp.

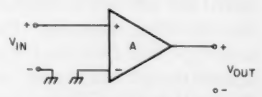


Fig. 2. An amplifier with a voltage gain of "A."

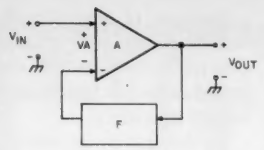


Fig. 3. An amplifier with feedback.

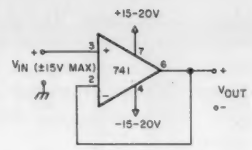


Fig. 4. A non-inverting buffer.

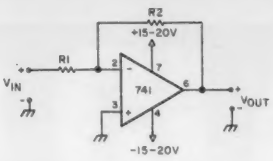


Fig. 5. An inverting amplifier.

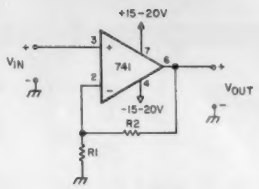


Fig. 6. A non-inverting amplifier.

in Fig. 3. Here, the block marked F is doing just that. We'll use F as the gain of this block, saying that F times the output is fed back to the input. In Fig. 2, the output was just an amplified version (A times) of the input. But what's happening in this new arrangement?

Well, the output of the amplifier—the triangle stage—still has to be A times as big as the input. But the input to the amplifier is no longer just the input signal, V_{in}. The input to the amp—the voltage difference between the two input terminals—is now the difference between V_{in} and F times the output. If we call this signal V_a (for voltage at the amplifier), we can write Equation 1 (see box).

It is this combined signal that the amplifier block is working with, so the amplifier output (and the output of the whole thing, since they're the same) must be A times V_a (see Equation 2).

What we'd really like, though, is some relation between the original input signal (V_{in}) and the output. Well, Equation 1 gives us V_a in terms of both of these, so we can get rid of that pesky V_a just by plugging in the right side of 1 for V_a (see Equation 3).

This says that the output depends on both the input and itself. (Well, what did you expect with feedback?) A few more algebraic tricks: dividing both sides by V_{out} and rearranging gives us Equation 4.

This might not look all that impressive at first glance (heck, it might not look that impressive at *second* glance), but let's think a bit about what it means. Remember, A is the gain of the triangle block in Fig. 3—the amplifier proper—and F is the gain of the feedback path around the amp. Since we know we're trying to find some use for a large gain amp, what happens if A in this equation becomes very large?

If A is a large number, then A times F must also be a large number, at least until F gets pretty small. And if A times F is large, then adding one to it shouldn't change it very much—I mean, 100,000 and 100,001 are pretty much the same, right? So in Equation 4, the 1 + (A × F) might just as well be simply A × F—the added one isn't going to make much difference one way or another. Well, if we drop the one we get Equation 5 which then, dividing through by A, results in Equation 6.

Now, *that's* something we can use. What this has all boiled down to is the fact that *if* our assumption about A × F being large is true, then the output does *not* depend on the actual gain of the amplifier at all! As long as the gain of the amplifier (A) is large enough to make A × F much bigger than one, the output of this whole gadget will depend only on the input and the gain of the feedback path, F. The gain of that path might actually turn out to be a loss; if F is one-fifth, then V_{out} will be five times the amplitude of V_{in} regardless of the actual gain of the op amp we use to build it!

What's actually happening here is that we're comparing a part of the output to the input and getting a signal (V_a) which is a measure of how far off the output is from the desired signal. V_a is an "error voltage." If V_{out} were an exact copy of V_{in}, just five times bigger, and we compare V_{in} with one fifth of V_{out}, we would expect an error voltage of zero. This is how negative feedback controls the output of the stage.

As an example, look at Fig. 4. Here, F is one; all of the output is being fed back to the input. This says that the output will be an exact copy of the input. This circuit, called a *non-inverting buffer*, is useful for picking off a sample of a certain signal without loading down that signal's source—remember, the op amp has extremely high input impedance. If you'd rather get an inverted version of the signal, you can use the *inverting amplifier* circuit of Fig. 5, with R1 = R2. (Actually, Fig. 4 is a special case of the *non-inverting amplifier* shown in Fig. 6—it just has R2=0 and R1 infinite.)

Figs. 5 and 6 show how feedback is applied for the cases of inverting and non-inverting amps. Fig. 6, the non-inverting amp, is probably the easiest to understand: R2 and R1 form a voltage divider and the voltage across R1 is what is compared to the input. So, for this case, the F of our earlier equations is simply the voltage divider, and we can write Equation 7.

Equation 8, a rearranged Equation 7, is the usual way of expressing the gain of this configuration. The inverting case is a bit more difficult to see since the feedback isn't in series with the input signal. But if you think of it in terms of current—the amount of current required through R2 to produce the same drop as a given amount through R1—then it looks like F will simply be the ratio of these resistances, and we get Equation 9. The minus sign shows up because this is an *inverting* amplifier—V_{out} is reversed from V_{in}. Notice that these circuits give us a quick and easy way to build voltage amplifiers with gains set simply by the proper selection of resistor values.

There are a couple of other things we can do with the inverting amp that you might be interested in. Since the gain is set by the ratio of the two resistors, we can use the circuit of Fig. 7 as a *mixer*. The output will be the sum of the input signals added in proportion to the ratio of their input resistor and the feedback resistor (see Equation 10). The input resistors might even be variable, as in Fig. 8, so that you can change the level of each signal simply by adjusting the proper potentiometer. This circuit could form the basis for an audio mixer for your home-brew PA system.

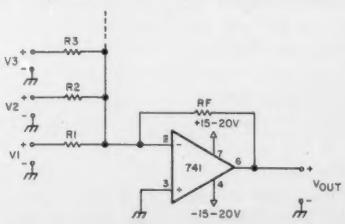


Fig. 7. An inverting amplifier used as a mixer.

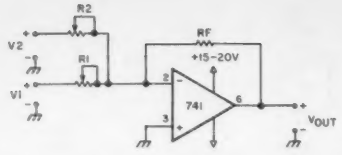


Fig. 8. Make the input resistors variable and you have the beginnings of an audio mixer.

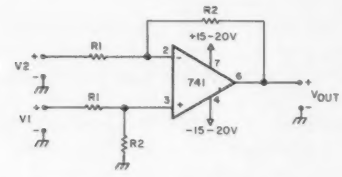


Fig. 9. A differential amplifier.

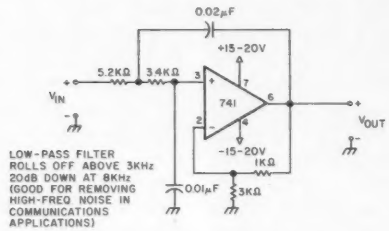


Fig. 10. A simple active filter.

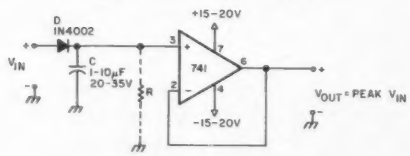


Fig. 11. A peak-detecting circuit.

Another interesting use for the op amp is the differential amplifier shown in Fig. 9. This circuit's output is related to the difference of the two input signals, V1 and V2. Note that the corresponding resistors on either side of the circuit are equal in value—R2A equals R2B, etc. The amplitude of the output is still set by the ratio of the resistances, and is expressed in equation II. This circuit can also be used for level shifting, if one of the inputs is fixed to a reference voltage.

But why limit ourselves to just resistances in the feedback loop? If we use some reactive components in this path (capacitors and inductors) we should be able to come up with a circuit whose output depends on the frequency of the input signal—in other words, a filter. Active filter design is a topic which can (and has) filled textbooks, but Fig. 10 shows a sample circuit to demonstrate the op amp's use in this area. Active filters turn out to be much simpler to design and build than their passive counterparts, due to the ease of isolating sections of the filter and the elimination of the need for inductors.

A couple of applications show some other uses of the op amp's characteristics. Fig. 11 is a *peak-detecting* circuit. Here, the capacitor charges to the peak voltage present at the input and stays there since it has no place to discharge. Remember, the input impedance of the op amp is very high, so it doesn't present much of a path for discharging the capacitor.

You should recognize the way the op amp is connected here—it's just the buffer from Fig. 4. One might place a resistor across the capacitor so that the cap will eventually discharge. The bigger the resistor, of course, the longer the cap will take to discharge and the closer the output will remain to the peak value. This circuit can be useful in tailoring meter responses, such as slowing down the response of some of the new bar-graph displays so that you can follow them more easily.

This should give you some idea of how to use the op amp for various jobs, and maybe already you can think of some applications for the circuits I've shown. There are, though, a few practical considerations to keep in mind.

First, the op amp usually will require both positive and negative supply voltages (though not always—see National Semiconductor's *Linear Databook* and *Linear Applications Handbook*). These supply voltages must not exceed the rating for the part you're using and will always limit the maximum amplitude allowed for the output. Make sure you're not asking for so much gain that you'd exceed this limit, or the output will clip at the maximum.

Also, while most modern op amps include some form of current limiting on the output, try not to use it. Keep your circuits running so that the op amp is running well within its maximum current-limit spec.

You should also be aware of the bandwidth and slew-rate limitations of the part you're using. *Slew rate*, usually expressed in something like volts per microsecond, is a measure of how fast the output voltage can change. This will determine how well the op amp can track signals at high frequency.

Compensation is another subject that often comes up for discussions of op-amp circuits. Here, I'm going to have to refer you to the manufacturer's data sheet for the op amp you're using. Some parts are *internally compensated*, while others will require that some external components (usually a resistor and capacitor in series) be added for compensation. All compensation means is that the frequency response of the amplifier is being adjusted to ensure that it will operate properly over the desired frequency range. This can be tailored to suit the application, but for now you're safest sticking with the recommended compensation for the part you're using. The 709, for example, wants around 2000 pF and 1.5k Ohms in series across its compensation leads; the 741 is internally compensated and needs no external components.

As with most ICs, supply bypassing is always a good idea—and don't forget you've got *two* supplies to worry about. A ceramic capacitor from each supply lead to ground, say around 0.1 uF, should be about right. You might want to add more, maybe a 10- or 20-uF tantalum if you're a good distance from the filter caps in your power supply or if you run into noise or oscillation problems.

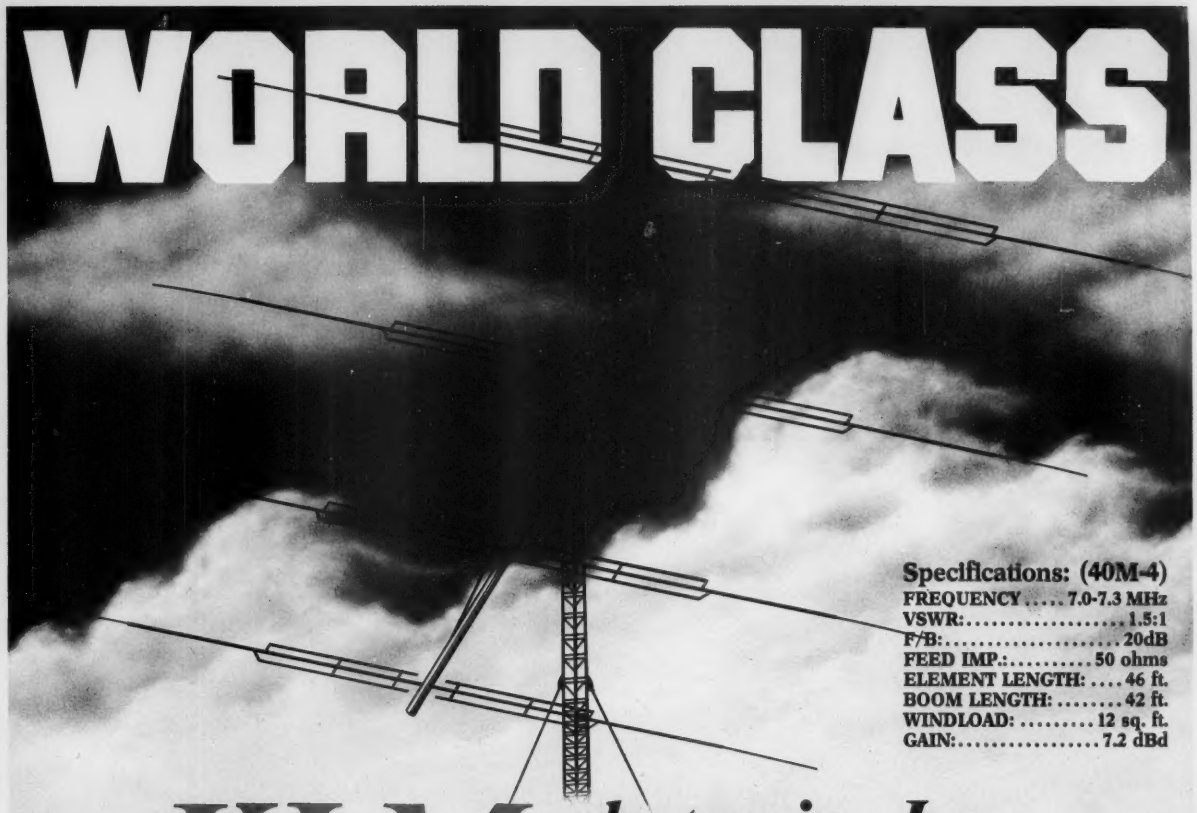
The applications for the operational amplifier are practically innumerable—so go right ahead and see what you can do with your own version of Op Art. ■

References

Linear Databook (1978) and *Linear Applications Handbook* (1978), National Semiconductor Corp.

Analysis and Design of Analog Integrated Circuits, Paul R. Gray and Robert G. Meyer, 1977, John Wiley and Sons, Inc.

WORLD CLASS



Specifications: (40M-4)
FREQUENCY ..... 7.0-7.3 MHz
VSWR: 1.5:1
F/B: 20dB
FEED IMP.: ..... 50 ohms
ELEMENT LENGTH: .... 46 ft.
BOOM LENGTH: ..... 42 ft.
WINDLOAD: ..... 12 sq. ft.
GAIN: ..... 7.2 dBd

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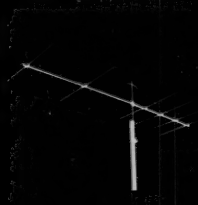
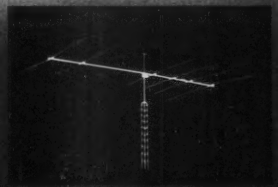
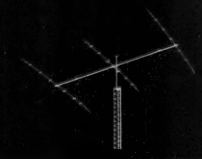


Specifications: (20M-6)
BANDWIDTH: ... 13.9-14.4 MHz
VSWR: 1.5:1
F/B ..... 35 dB
FEED IMP.: ..... 50 ohms
ELEMENT LENGTH: .... 37 ft.
BOOM LENGTH: ..... 57 ft.
WINDLOAD: ..... 12.8 sq. ft.
GAIN: ..... 11 dBd



Specifications: (30M-3)
BANDWIDTH: ... 10.1-10.150 MHz
VSWR: 1.5:1
F/B ..... 20 dB
FEED IMP.: ... 50 ohms unbal.
ELEMENT LENGTH: .... 35'6"
BOOM LENGTH: ..... 24'3"
WINDLOAD: ..... 7 sq. ft.
GAIN: ..... 7.0 dB

Specifications: (15M-6)
BANDWIDTH: ... 21.0-21.5 MHz
VSWR: 1.5:1
F/B: ..... 30 dB
FEED IMP.: ..... 50 ohms
ELEMENT LENGTH: .... 25 ft.
BOOM LENGTH: ..... 36 ft.
WINDLOAD: ..... 8.5 sq. ft.
GAIN: ..... 10.5 dBd



Specifications: (7.2/10-30-7LPA)
BANDWIDTH: ..7.2/10-30 MHz
VSWR: ..... 2:1 typical
F/B: 10/15
FEED IMP.: ..... 50 ohm unbal.
ELEMENT LENGTH: .... 46 ft.
BOOM LENGTH ..... 42 ft.
WINDLOAD: ..... 12 sq. ft.
GAIN ..... 3/7 dBd typical

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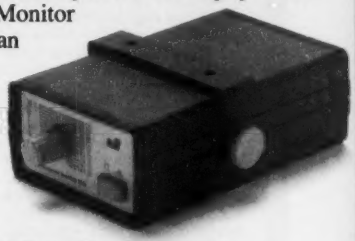

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77.0 XB	100.0 1Z	131.8 3B	173.8 6A
79.7 SP	103.5 1A	136.5 4Z	179.9 6B
82.5 YZ	107.2 1B	141.3 4A	186.2 7Z
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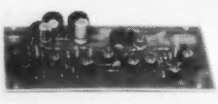

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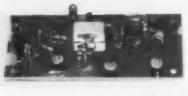

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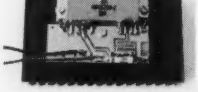

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Put the DX World on a Screen

Everything you need to know about a country can be at your fingertips. All you need is a VIC-20 and this program.

How many times have you been sitting at your receiver listening to the DX come in when you suddenly heard a prefix that you couldn't identify at all? Well, if you own a VIC-20 with at least an 8K expansion cartridge or an Apple II Plus, your worries are over. With this program, all you have to do after loading it is enter the prefix at the keyboard and a variety of pieces of helpful information will appear on your screen.

Immediately available to you will be the name of the country, its latitude and longitude, prefix, antenna bearings, and distance in miles and kilometers. At the touch of another key, the computer will check for any other country listed by the same prefix. If you still are unsure of the location of the country, the computer can indicate which countries border the one in question.

In the Apple program, many of the major cities in the United States and around the world are included in the data so that you can determine exactly how far it is to New York, Denver, Colorado, or even Paris, France. In the program for the unexpanded VIC, only major US cities have been included in the data. A useful feature of this program is that the user can customize it for individual needs. If you are a VHF enthusiast, you can enter cities located within your listening radius.

Adaptability

The locator program can be adapted to almost any size of memory from the VIC-20's small 3.5K to the Apple II Plus with its 48K. I have found that in order to get all the prefixes in the world excepting the US, one needs at least 11773 bytes, or 12K of memory.

With this program, bearings and distances can be figured by the latitude and longitude on the keyboard. In this mode, the computer can perform a search and identify the countries located around your coordinates. Another feature of this program is that if you enter the name of a country or island on the keyboard, the computer can tell you where the country is, its prefix, antenna bearing, and distance. At the touch of a key, the country's alternative prefix is provided, if it has one.

Program Run

After loading the program, type in the RUN command. At this time you will be presented with the following main menu with four selections: (1) Country or City, (2) Prefix, (3) Latitude and Longitude, and (4) Quit.

For our first example, let's take selection (1). Keystrokes: 1<RET>. Now you will be asked to enter the name of a country or city. Enter the name of the country in question. For our purpose, enter ITALY. Keystrokes: ITALY <RET>. The screen will clear. Then the flashing prompt SEARCHING DATA will appear. If the information is not found, the screen will clear, a prompt will say END OF DATA, and the program will return you to the main menu. If the data is found, the screen will clear and the information will appear.

First will be the name of the country. Next will be the latitude and longitude, followed by the prefix, antenna bearings, and the distance in miles or kilometers. At the bottom of your screen will be the prompt (F7)=SEARCH DATA OR HIT ANY KEY. If you press any key, you will return to the main menu. If you press the F7 key, the computer will search for any other listings for the country entered. If there are none, the program will return to the main menu. If there is another prefix, the alternative prefix and the country's data will be provided.

Now let's go back to the main menu again. Let's pick the second selection. Keystrokes: 2<RET>. You will now be asked for a prefix. For our example, let's use TT. Keystrokes: TT<RET>. Again the screen will go blank and the prompt SEARCHING DATA will appear. When the data is found, the prompt will stop flashing, the screen will clear, and the information for the Republic of Chad will appear. If you press the

F7 key, the computer will search for any other countries listed by the prefix TT. Finding none, the computer will return to the main menu.

For the third selection, keystroke 3<RET>. The screen will clear and then a prompt will appear asking for latitude. If it is a north latitude, enter the number as a positive number. If it is a south latitude, enter it as a negative number. For example, let's use negative 45 degrees. Keystrokes: −45 <RET>. If you enter a number larger than 90 or less than negative 90, you will get an error message and be asked for the information again. The program, as we say in computer language, will not crash.

After you have entered the latitude and pressed the Return key, another prompt will appear requesting the longitude. Enter east longitude as a positive number and west longitude as a negative number. For our example, enter a positive 120 degrees. Keystrokes: 120<RET>. The computer will not accept any number larger than a positive 180 or less than a negative 180. A prompt will appear to ask you if your data is correct. Enter either a 1 for Yes or 2 for No. If you type a 2, the program will ask you for the correct latitude and longitude.

Our data is correct so you can press 1. The screen will display the latitude and longitude, the antenna bearings, and the distance in miles to the coordinates you have entered. At the bottom of the screen you will find the prompt (F7)=SEARCH DATA OR HIT ANY KEY. Any key will return you to the main menu. If you press the F7 key, this screen will first clear and this prompt will appear: I WILL SEARCH MY FILE FOR DATA ON LOCATION NEAR YOUR COORDINATES. HOW WIDE OF SEARCH IN DEGREES? You can enter any number between 1 and 360. Let's enter 20. Keystrokes: 20<RET>. The computer will go through its data file and locate any coordinates within 20 degrees of the search area. If the computer finds any country around the entered coordinates, it will stop the search and print the data on the screen. If you press the F7 key again, it will continue the data search for another country around your coordinates. When the program comes to the end of the data file, the screen will clear and the prompt END OF DATA will appear and return you to the main menu.

The last selection on our menu is number 4. I do not think this needs any explanation.

Now that we have been through the programs, let me point out a few things. First, when entering a city or country name, it must be spelled correctly. If the country in question is an island, it needs to be entered as such, e.g., CAICOS IS. Secondly, when entering south, north, east, or west, there should be no space between the abbreviation, the period, and the name, e.g., W.SAMOA. Whenever the word Saint is used, it should be abbreviated as ST, e.g., ST. VINCENT IS. This is done to conserve as much memory for data statements as possible.

I chose Basic for the program because of the language adaptability, and this makes it easy for the user to customize the program for special needs. A big gun DX-er may want prefixes from around the world while the net operator may want only cities across the nation.

The program design is as simple as I could make it to accommodate a lack of memory. Rewriting the program for the Sinclair, Atari, or the TRS computers should not be difficult. As you look through the listing, you will notice a few special characters. These generally concern the screen display. For a definition of some of the VIC special characters, refer to the sample run accompanying this article.

For a look at how the program works, start at line 10. Line 10 is where the main menu is printed. Line 24 is a very important line. This is where the user puts his information concerning his location. CLR will clear all variables. RESTORE returns the data pointer to the start of the data statements. The variable A is the latitude of the user's QTH. L1 is the variable for the user's longitude and SP$ is the name of the user's city and state. Line 25 is the input line for your selection from the main menu and line 26 sends the program on its way.

Line 50 is the start of the routine for entering the name of the city or country. C$ is the name of the country we are looking for. Line 55 is the gosub that sends the program to the read statement and a line of data is then read. After the data is read and the variables Z$ prefix, L$ name of the city or country, B latitude, and L2 longitude are filled in, then the program compares the L$ and the C$. If the L$ and C$ are the same, the program goes to subroutine 500 and then to line 200, the display routine. If the variables are different, the computer reads another line of data.

Line 57 checks to see if all data has been looked at. If it has, the program goes to line 250 and does an end-of-data routine. Lines 60 through 64 work the same as lines 50 through 58 except that the variables H$ and Z$ are compared for a match.

Lines 70 through 84 are the routine for entering the latitude and the longitude. Lines 85 through 110 are the area where I put the gosubs. Line 85 is the error message for whenever the user inputs data the computer cannot use. Line 100 is the flashing SEARCHING DATA prompt and the read statement. Line 110 is a delay loop.

Lines 200 through 227 contain the routine which displays the information after it has been processed by the math subroutine located on lines 500 through 900. Line 200 prints the value of L$, the name of the state or country. Line 201 prints the latitude, B. Line 202 prints the longitude, L2, and line 205 prints the prefix, Z$. Line 210 prints antenna bearings, R2, derived from the math routine. Line 215 prints the name of the starting point, home QTH, and the distance in miles from SP$. Line 220 prints the distance in kilometers from SP$. Line 224 prints the prompt at the end of the display, (F7)=SEARCH DATA OR HIT ANY KEY.

At this prompt, the program waits for you to press a key. If you press the function key, F7, the program will go into the search routine depending on what selection you choose from the main menu. Lines 227 through 230 take care of this function. If you press any other key, the program will return to the main menu, line 232.

Lines 235 through 244 are the search routine used for main menu selection number 3, the latitude and longitude. Line 239 checks for the end of data. Lines 240 through 243 filter the value of the latitude and longitude read in the data statement. If all conditions are met, the value of the variables is filled from the math routine (lines 500 through 900) and forwarded to the display routine. Line 250 is the executed line whenever the data read statement reaches the end of the data (line 3000).

Math Routine

The math routine was derived from two sources, the *ARRL Antenna Handbook* and a math routine used in a program published in *The Giant Book of Computer Software* (1st Ed., pp. 264-265). I made a lot of changes in order to save memory, but basically it works the same. The math routine is

```
1 PRINT"■■■■■■■LOCATOR PROGRAM (C)82":PRINT"BY E. MORGAN":GOSUB110
10 PRINT"■    ■■MAIN MENU■■":PRINT"■■HOW DO YOU WANT ME TO LOCATE DATA?"
15 PRINT"■■1..COUNTRY OR CITY":PRINT"■2..PREFIX":PRINT"■3..LAT.& LONG.":PRINT"■4
..QUIT"
24 CLR:RESTORE:R=41.14:L1=-111.58:SP$="OGDEN, UTAH"
25 PRINT"■":INPUTE
26 ONEGOTO50,60,70
31 IFE=4THENPRINT"■":END
35 GOTO25
50 PRINT"■■ENTER COUNTRY OR CITY.":INPUTC$:IFC$="E"THEN10
55 GOSUB100
56 IFL$=C$THENGOSUB500:GOTO200
57 IFZ$="END"THEN250
58 GOTO55
60 PRINT"■ENTER PREFIX":INPUTH$:IFH$="E"THEN10
61 GOSUB100
62 IFZ$=H$THENGOSUB500:GOTO200
63 IFZ$="END"THEN250
64 GOTO61
70 PRINT"■LATITUDE?":INPUTB:IFB>90ORB<-90THENGOSUB85:GOTO70
77 PRINT"■LONGITUDE?":INPUTL2:IFL2>180ORL2<-180THENGOSUB85:GOTO77
78 PRINT"■IS YOUR INPUT CORRECT":PRINT"1=YES 2=NO":INPUTW
79 ONWGOTO84,70
84 PRINT"■":GOSUB500:GOTO201
85 PRINT"■ERROR":GOSUB110:RETURN
100 PRINT"■■■■■■■■  SEARCHING DATA!":READZ$,L$,B,L2:RETURN
110 FORT=1TO3000:NEXT:RETURN
200 PRINT"■■■L$"■■"
201 PRINT"■LATITUDE  "B
202 PRINT"LONGITUDE "L2
205 PRINT"■PREFIX "Z$
210 PRINT"■■EARING"R2
215 PRINT"■■DISTANCE FROM ";PRINTSP$"■";PRINTD1" MILES"
220 PRINT"■"D2" KILOMETERS"
224 PRINT"■■■(F7)=SEARCH DATA OR    HIT ANY KEY."
226 GETS$:IFS$=""THEN226
227 PRINT"■":IFS$<C■R■(136)ANDE=3THEN235
230 IFS$=CHR$(136)ANDE=2THEN61
231 IFS$=CHR$(136)ANDE=1THEN55
232 IFS$=CHR$(136)ANDE=0THEN238
233 GOTO10
235 PRINT"■I WILL SEARCH MY FILE FOR DATA ON LOCATION  NEAR YOUR CORDINATE."
236 PRINT"■■ON WIDE OF SEARCH IN DEGREES?":INPUT0%
237 ZB=B:ZL=L2
238 GOSUB100
239 IFZ$="END"THEN250
240 IFB>ZB+0%THEN238
241 IFB<ZB-0%THEN238
242 IFL2>ZL+0%THEN238
243 IFL2<ZL-0%THEN238
244 E=0:GOSUB500:GOTO200
250 PRINT"■■  END OF DATA!":GOSUB110:GOTO10
500 A1=R■■/180:L=L2-L1:X=0
510 IFL<-180THEN525
515 IFL>180THEN535
520 GOTO540
525 L=L+360:GOTO610
535 L=L-360
540 IFL>180THEN610
545 X=1
610 B1=B■■/180:L=L■■/180:P=COS(L)■COS(A1)■COS(B1)+SIN(A1)■SIN(B1)
625 P1=ATN(SQR(1-P■P)/P):P2=P1■180/■
635 IFP2<0GOTO645
640 GOTO650
645 P2=P2+180
650 D1=INT(P2■60■1.15152+.5):D2=INT(D1■1.6093+.5)
655 R=COS(B1)■SIN(L)/SIN(P1):R1=ATN(R/SQR(1-R■R)):R2=INT((R1■180/■)+.5)
670 IFABS(R)>.999999THEN800
675 IFABS(R)<.00174THEN850
680 B2=(B+.1)■■/180:R=COS(L)■COS(A1)■COS(B2)+SIN(B2)■SIN(A1)
690 R4=ATN(SQR(1-P3■R3)/P3):R6=COS(B2)■SIN(L)/SIN(R4)
705 IFX=1THEN740
710 IFABS(R6)>ABS(R)THEN730
715 R2=360-ABS(R2):GOTO900
730 R2=180+ABS(R2):GOTO900
740 IFABS(R6)<ABS(R)THEN755
745 R2=180-ABS(R2):GOTO900
755 R2=ABS(R2):GOTO900
800 IFX=1THEN830
810 R2=270:GOTO900
830 R2=90:GOTO900
850 IFABS(L)>178THEN870
855 IFB<ATHEN865
860 R2=0:GOTO900
865 R2=180:GOTO900
870 IFB<ATHEN865
875 GOTO860
900 RETURN
1000 DATARC4,SIKKIM,32,83,AP,PAKISTAN,31.88,A2,BOTSWANA,-22,24,ZS9,BOTSWANA,-22,
24
1001 DATA35,TONGA,-21,-175,A4,OMAN,20.58,A5,BHUTAN,27.90,AC5,BHUTAN,27,90
1002 DATA6,UNITED ARAB EMIRATES,24.54,A7,QATAR,25.51,A9X,BAHRAIN,26.50
1003 DATA9X,BAHRAIN,26.50,BY,TAIWAN,23,121,BY,CHINA,35.105,CE,CHILE,-30,-71
1004 DATACE0A,EASTER IS.,-21,-177,CE0X,SAN FELIX IS.,-26,-80
1005 DATACE0Z,JUAN FERANDEZ IS.,-33,-79,CM,CUBA,21,-80,CO,CUBA,21,-79
1006 DATACN,MOROCCO,32,-5,CP,BOLIVIA,-15,-65,CR3,GUINEA BISSAU,12,-15
1007 DATAJ5,GUINEA BISSAU,12,-15,CR5,PRINCIPE IS.,1.7,89,PRINCIPE IS.,1.7
1008 DATACR5,SAO TOME IS.,12.6,89,SAO TOME IS.,12,6,CR8,TIMOR IS.,-10,125
1009 DATACR9,MACAO,22.113,CT1,PORTUGAL,39,-8,CT2,AZORES IS.,38,-28
1010 DATACT3,MADEIRA IS.,32,-16,5,CX,URUGUAY,-33,-56,CZ,NAURA IS.,-.3,166.5
1011 DATAD9,NAURA IS.,-.3,166,5,C3,ANDORRA IS.,42.1,FX,ANDORRA IS.,42,1
1012 DATAC5,GAMBIA,13,-15,ZD3,GAMBIA,13,-15,C6,BAHAMA IS.,25,-75
1013 DATAVF7,BAHAMA IS.,25,-75,C9,MOZAMBIQUE,-18,35,CR7,MOZAMBIQUE,-18,35
1014 DATAD,W.GERMANY,51.9,DM,E,GERMANY,52,12,V2-V9,E,GERMANY,52.12
1015 DATADU,PHILLIPPINES,12,125,DX,PHILLIPPINES,12,125,D2,ANGOLA,-12,18
1016 DATAD3,ANGOLA,-12,18,D4,CAPE VERDE,16,-24,EA,SPAIN,40,-4
1018 DATAER9,MELILLA,35,-2,EI,IRELAND,53,-8,EL,LIBERIA,6,9,EP,IRAN,33,55
1019 DATAET,ETHIOPIA,9,39,F,FRANCE,46,2,FB8W,CROZET IS.,-46,53,FB8X,KERGUELEN IS
. -49,69
1020 DATAFB8Z,ST.PAUL & AMSTERDAM IS.,-38,73,FC,CORSIA,42,9,FG7,GUADELOUPE,16,-6
1
1021 DATAFH,MAYOTTE IS.,-12,5,45,D6,COMORO IS.,-12,44,FK8,NEW CALEDONIA,-21,165
1022 DATAFL8,DJIBOUTI,11,43,J2,DJIBOUTI,11,43,FM7,MARTINIQUE,14,4,-61
1023 DATAFO8,FRENCH POLYNESIA,-18.-149,FO8,CLIPPERTON IS.,10,-109
1024 DATAFP8,ST.PIERPE IS.,46,5,-56,FP8,MIQUELON IS.,47,-56,FR,REUNION IS.,-21,55
1025 DATAFR,GLORIOSO IS.,-9,51,FR,JUAN DE NOVA IS.,-17,42,5,FR,TROMELIN IS.,-15.
5,54
1026 DATAFS,ST.MARTIN IS.,18,63,FG,ST.MARTIN IS.,18,63,FW8,WALLIS & FUTUNA IS.,-
14,-177
1027 DATAFV7,FRENCH GUIANA,4,-51,G,ENGLAND,52,-1,GD,ISLE OF MAN,54,-4
1028 DATAGI,N.IRELAND,55,-8,GJ,JERSEY IS.,49,-2,GC,JERSEY IS.,49,-2,GM,SCOTLAND,
57,-4
1029 DATAGU,GUERNSEY IS.,49,-2,GC,GUERNSEY IS.,49,-2,GW,WALES,52,-3
1030 DATAHA,HUNGARY,47.20,HG,HUNGARY,47.20,HB,SWITZERLAND,47.8,HE,LIECHENSTEIN,4
7.9,4
1031 DATAHB0,LIECHENSTEIN,47.9,4,HC,ECUADOR,0,-78,HC8,GALAPAGOS IS.,-,3,-90.3
1032 DATAHH,HAITI,18.-72,5,HI,DOMINICAN REP.,19,-70,HK,COLOMBIA S.,-75,HK,KOREA,3
7.127
1033 DATAHK0,PROVIDENCIA IS.,-9.51,HK0,MALPELO IS.,3,6,-81.4,HL,KOREA,37,127
1034 DATAHK0,SERRANE BANK & RONCADOR CAY,14,-80,KP3,SERRANE BANK & RONCADOR CAY,
14,-80
1035 DATAKS4,SERRANE BANK & RONCADOR CAY,14,-80,HK0,SAN ANDRES IS.,13,-83
1036 DATAHP,PANAMA,9,-80,HR,HONDURAS IS.,15,-86,HR,SWAN IS.,44,-68,2,HS,THAILAND
,15,100
1037 DATAHV,VATICAN CITY,41.54,12.27,HZ,SAUDIA ARABIA,25.45,7Z,SAUDIA ARABIA,25.
45
1038 DATAI,ITALY,42.12,IT,SICILY,37,14,IS,SARDINIA,40,9,IM,SARDINIA,40,9
1039 DATAIA-IN,JAPAN,35,139,JD,OGASAWARA IS.,28.142,KA1,OGASAWARA IS.,35.5,139.5
1040 DATAID,MINAMI-TORI-SHIMA IS.,24.154,KA1,MINAMI-TORI-SHIMA IS.,24.154
1041 DATAJT,MONGOLIA,46,100,JW,SVALBARD IS.,78.5,16,LA,SVALBARD IS.,78.5.16
1042 DATALP,SVALBARD IS.,78.5,16,JX,JAN MAYEN IS.,72,-9,LA,JAN MAYEN IS.,72,-9
1043 DATALP,JAN MAYEN IS.,72,-9,JY,JORDON,31.36,KB,BAKER IS.,,1,178,KH1,BAKER IS
.,,1,178
1045 DATAKB,HOWLAND IS.,1,-178,KH1,HOWLAND IS.,1,-178,KC4,NAVASSA IS.,19,-75
1046 DATAKP1,NAVASSA IS.,19,-75,KC6,CAROLINE IS.,8.148,KG4,GUANTANAMO BAY,20.1,-
75.1
1047 DATAKG6,MARIANA IS.,15.145,KH8,MARIANA IS.,15.145,KG6,GUAM IS.,13.144.5
1048 DATAKH2,GUAM IS.,13.144.5,KH6,HAWAII IS.,20.-157.5,KH7,KURE IS.,27,-178
1049 DATAKJ6,JOHNSTON IS.,17.-169,KH3,JOHNSTON IS.,17.-169
1050 DATAKM6,MIDWAY IS.,28.-177,KM4,MIDWAY IS.,28.-177,KP4,PUERTO RICO,18.-66.5
1051 DATAKP6,KINGMAN REEF,7.-163,KH5,KINGMAN REEF,7,-163,KP6,JARVIS IS.,-.4.-160
1052 DATAKP6,PALMYRA IS.,6.-163,KS6,AMER.SAMOA,-14,-170.5,KH8,AMER.SAMOA,-14.-17
0.5
1053 DATAKV4,VIRGIN IS.,17.4,-65,KW6,WAKE IS.,19,166,4,LA,NORWAY,62,10
1054 DATAKH9,WAKE IS.,19.166.4,KX6,MARSHALL IS.,10,178,LB,NORWAY,62,10
1055 DATALF,NORWAY,62.10,LG,NORWAY,62,10,LJ,NORWAY,62,10,LU,ARGENTINA,-40,-65
1056 DATALX,LUXEMBOURG,49.5,6,LZ,BULGARIA,43.25,M1,SAN MARINO,43,6,12.3
1057 DATAOH,FINLAND,64.26,OF,FINLAND,64.26,OH0,ALAND IS.,60,1,20,0J0,MARKET REEF
,64,21
1058 DATAOK,CZECHOSLOVAKIA,50.19,ON,BELGIUM,50,4,OX,GREENLAND,70,-40
1059 XP,GREENLAND,70,-40,OY,FAEROES IS.,62,-7,OZ,DENMARK,56.10,PA,NETHERLANDS,52
.5
1060 DATAPD,NETHERLANDS,52.5,PE,NETHERLANDS,52.5,PI,NETHERLANDS,52.5
1061 DATAPJ,NETHERLANDS ANTILLES IS.,12,-69,PJ,ST.EUSTATIUS,12,-69,PJ,SABA IS.,1
2,-7
1062 DATAKP2,VIRGIN IS.,17.4,-65,PJ,ST.MAARTEN IS.,12,-69,PY,BRAZIL,-10,-50
1063 DATAPV0,TRINDADE &MARTIM IS.,-20.3,-29,PV0,ST.PETERS & ST.PAULS ROCK,2.29,5
1064 DATAPV0,FERNANDO DE NORANHA IS.,-3,5.32,PZ,SURINAM,5,-55,P2,NEW GUINEA,-7.1
44
1065 DATASK,SWEDEN,62,15,9L,SWEDEN,62,15,SM,SWEDEN,62,15,SP,POLAND,52,19,3Z,POLA
ND,52,19
1066 DATAST,SUDAN,15.30,SU,EGYPT,27.30,SV,GREECE,39.22,SV,GRETE,35,24.5
1067 DATASV,DODGECANESE IS.,36,6,26,S2,BANGLADESH,24.90,TA,TURKEY,39,35
1068 DATATF,ICELAND,65,-18,TG,GUATAMALA,15,-90,TI,COSTA RICA,10,-85,TI9,COCOS IS
.,5,-87
1069 DATATJ,CAMEROON,6,12,TL,CENTRAL AFRICAN REP.,7.21,TN,CONGO,-1,15,TR,GABON,-
1.11.5
1070 DATATT,CHAD,15,19,TU,IVORY COAST,8,-5,TY,BENIN,9.2,TZ,MALI,17,-4,UA,U.S.S.R
.,55,80
1071 DATAUK,U.S.S.R.,55,80,UT,U.S.S.R.,55,80,UB,U.S.S.R.,55,80,UY,U.S.S.R.,55,80
1072 DATAVE,CANADA,60,-95,VY,CANADA,60,-95,VK,AUSTRALIA,-25,130
1073 DATAVK,AUSTRALIA,-25,130,VK2,LORD HOWE IS.,-31.3,159,VK9,NORFOLK IS.,-29,16
7.6
1074 DATAVK9,CHRISTMAS IS.,-10,105,VK9,COCOS IS.,-12.5,97,VK9,MELLISH REEF,,-17.
2,155,
1075 DATAVKR,HEARD IS.,-63.74,VK0,MACQUARIE IS.,-63,74,VK0,MCDONALD IS.,-54.74
1076 DATAVO1,NEW FOUNDLAND,52.-56,VO2,LABRADOR,54,-62,V3,BELISE,17,-88,J3,GRENAD
A,12,-61.4
1077 DATAV2,ANTIGUA & BARBUDA,17.-61.5,VP2A,ANTIGUA & BARBUDA,17,-61.5
1078 DATAJ7,DOMINICA IS.,15,-61,VP2D,DOMINICA IS.,15,-61,VP2E,ANGUILLA IS.,18,-6
3
1079 DATAVP2K,ST.KITTS & NEVIS IS.,17.-64.5,VP2L,ST.LUCIA IS.,15.5,-61
1080 DATAJ6,ST.LUCIA IS.,15.5,-61,VP2M,MONTSERRAT IS.,16.5,-62.1,J8,ST.VINCENT I
S.,13,-61
1081 DATAVP2S,ST.VINCENT IS.,13,-61,VP2V,BRITISH VIRGIN IS.,18,-64,VP5,TRUK IS.,
21.5,-71
1082 DATAVP5,CAICOS IS.,21.5,-71,VP8,FALKLAND IS.,-51,-60,LU,FALKLAND IS.,-51,-6
0
1083 DATAVP8,S.GEORGIA IS.,-54,-36.5,LU-LZ,S.GEORGIA IS.,-54,-36.5
1084 DATAVP8,S.ORKNEY IS.,-61,-45,LU-LZ,S.ORKNEY IS.,-61,-45
1085 DATAVP8,S.SANDWICH IS.,-58,-38,LU-LZ,S.SANDWICH IS.,-58,-38
1086 DATAVP8,S.SHETLAND IS.,-65,-65,LU-LZ,S.SHETLAND IS.,-65,-65,VP9,BERMUDA IS.
,32,-64
1087 DATAVQ9,CHAGOS IS.,-8.73,VQ9,SEYCHELLES IS.,-4.55,S7,SEYCHELLES IS.,-4.55
1088 DATAVR1,GILBERT & OCEN IS.,-.5.169,T30,GILBERT & OCEAN IS.,-.5.169
1089 DATAVR1,PHOENIX IS.,-4.-171,T31,PHOENIX IS.,-4.-171,VR3,LINE IS.,-5.-154
1090 DATAT2,LINE IS.,-5.-154,VR4,SOLOMON IS.,-8.159,H4,SOLOMON IS.,-8.159
1091 DATAVR6,PITCAIRN IS.,-25.-130,VR6,TUVALA IS.,-8.178,VS5,BRUNEI,4,114
1092 DATAVS6,HONG KONG,22.1.114,VS9,KAMARAN IS.,15.42,VU,INDIA,23,80
1093 DATAVU2,ANDAMAN &NICOBAR IS.,12.92,VU2,LACCADIVE IS.,10.73,XE,MEXICO,23,-10
2
1094 DATAXF,MEXICO,23.-102,4A,MEXICO,23.-102,6D,MEXICO,23.-102
1095 DATAXF4,REVILLAGIGEDO IS.,19.-111,3,6D4,REVILLAGIGEDO IS.,19.-111.3
1096 DATAXT,VOLTAIC REP.,12.-1,XU,CAMBODIA,13.105,XV5,VIETNAM,16,108
1097 DATAXW8,LAOS,18.105,XZ,BURMA,22.98,YA,AFGHANISTAN,33,65,YB,INDONESIA,-5,120
1098 DATAYS,EL SALVADOR,13.5,-88,5,YU,YUGOSLAVIA,44.19,YT,YUGOSLAVIA,44.19
1099 DATAYV,VENEZUELA,8,-66,4M,VENEZUELA,8,-66,YV0,AVES IS.,12,-67,3,ZA,ALBANIA,
41,20
1100 DATAZB2,GIBRALTAR,36.5,ZD7,ST.HELENA IS.,15.6,-5.4,ZD8,ASCENSION IS.,-5.6,-
14
1101 DATAZD8,TRISTAN DA GUNHA,-37,-12,ZD9,GOUGH IS.,-40,-9,ZE,ZIMBABWE,-20,30
1102 DATAZ2,ZIMBABWE,-20,30,ZF1,CAYMAN IS.,19,-80,ZK1,COOK IS.,-20,-158
1103 DATAZK2,NIUE IS.,-19,-169,5,ZL,NEW ZEALAND,-41,174
1104 DATAZL,CHATMAN IS.,-44,-176,ZL,AUCKLAND IS.,-52,176,ZL,CAMPBELL IS.,-53,169
1105 DATAZL,KERMADEC IS.,-31,-178,5,ZM7,TOKELAU IS.,-8,-173,ZP,PARAGUARY,-23,-58
1106 DATAZS,S.AFRICA,-30,26,ZS2,PRINCE EDWARD IS.,-47,38,ZS2,MARION IS.,-47,38
1107 DATAZS3,NAMIBIA,-22,17,1A,SOVERIGN MILITARY ORDER OF MALTA,35.5,14.3
1108 DATAIS,SPRATLY IS.,8.112,3A,MONACO,43.5,7,3B6,AGALEGA IS.,-10,56.4
1109 DATA3B7,ST.BRANDON IS.,-17.69,3B8,MAURITIUS IS.,-20,57,3B9,RODRIGUEZ IS,,-1
9.64
1110 DATA3C,EQUATORIAL GUINEA,2.10,EA8,EQUATORIAL GUINEA,2.10,3D2,FIJI IS.,-18.1
75
1111 DATAV82,FIJI IS.,-18.175,3D6,SWAZILAND,-26,31,ZS7,SWAZILAND,-26,31
1112 DATAZD5,SWAZILAND,-26.31,3V8,TUNISIA,34.9,3X,REP.OF GUINEA,11,-10
1113 DATA7G,REP.OF GUINEA,11,-10,3Y,BOUVET IS.,-54,5,LA-LG,BOUVET IS.,-54,5
1114 DATAS7,SRI LANKA,7.81,3C0,ANNOGON IS.,-2.6,4U,ITU NEW YORK,40,4,-74
1115 DATA4U1,ITU GENEVE,46.6,4W,N.YEMAN,15,44,4X,ISRAEL,31.35,4Z,ISRAEL,31.35
1116 DATA5A,LIBYA,27.17,5B4,CYPRUS,35.33,ZC4,CYPRUS,35.33,5H3,TANZANIA,-6.35
1117 DATAVQ5,TANZANIA,-6.35,5N2,NIGERIA,10.8,ZD2,NIGERIA,10.8,5R8,MADAGASCAR,-19
,45
1118 DATAFF8,MADAGASCAR,-19,46,5T,MAURITANIA,20,-12,5U7,NIGER,16.8,5V,TOGO,8,1
1119 DATASW1,W.SAMOA,-13,5,-172,5X,UGANDA,1.32,VQ5,UGANDA,1.32,524,KENYA,1.38
1120 DATAVQ4,KENYA,1.38,5O,SOMALI,10.49,6W8,SENEGAL,14,-14,6Y5,JAMAICA,18,-77
1121 DATAVP5,JAMAICA,18,-77,70,S,YEMAN,15,48,VS9A,S.YEMAN,15,48,7P8,LESOTHO,-29,
28
1122 DATAZS8,LESOTHO,-29,28,70,MALAWI,-13,34,ZD6,MALAWI,-13,34
1123 DATA7X,ALGERIA,28.3,FA,ALGERIA,28.3,8P,BARBADOS IS.,13,-59,VP6,BARBADOS IS.
,13,-59
1124 DATA8Q,MALDIVE IS.,3.73,VS9M,MALDIVE IS.,3.73,8R,GUYANA,5,-59
1125 DATAVP3,GUYANA,5,-59,8Z4,SAUDI ARABIA & IRAQ NEUTRAL ZONE,30.43,901,GHANA,8
,-2
1126 DATA7D4,GHANA,8,-2,TA0,MALTA,35.5,14.4,V02,ZAMBIA,-15,30,9J,ZAMBIA,-15,30
1127 DATA9K2,KUWAIT,29.47,5,9L1,SIERRA LEONE,8,-11,9M2,W,MALAYSIA,5,102
1128 DATA9M4,W.MALAYSIA,5,102,9M6,E,MALAYSIA,5,117,9M8,SARAWAK,4.115,9N1,NEPAL,2
8,84
1129 DATA9Q5,ZAIRE,-4.25,005,ZAIRE,-4.25,9U5,BURUNDI,-3.30,9V1,SINGAPORE,1.2,103
.5
1130 DATA9X,RWANDA,-2.30,9Y4,TRINIDAD & TOBAGO IS.,11,-61,VP4,TRINIDAD & TOBAGO
IS.,11,-61
3000 DATAEND,0,0,0
```

performed only when there is a match between what is input by the operator (lines 50 and 60) and what is read in line 100 or when latitude and longitude are entered, main menu selection number 3 (lines 70 through 84).

Line 500 converts A to radians. Lines 510 through 545 determine the value of L and send the program to the correct place as determined by that value. The variable X is used to test the value of L. The first part of line 610 con-

Program listing.

```
Type:    RUN
Display: **MAIN MENU**
         HOW DO YOU WANT ME
         TO LOCATE DATA?
         1..COUNTRY OR CITY
         2..PREFIX
         3..LAT. & LONG.
         4..QUIT
Type:    1<RET>
Display: ENTER COUNTRY OR CITY.
         ?
Type:    ITALY<RET>
Display: SEARCHING DATA
Display: ITALY
         LATITUDE 42
         LONGITUDE 12
         PREFIX: I
         BEARING: 39
         DISTANCE FROM OGDEN,
         UTAH
         5899 MILES
         9171 KILOMETERS
         (F7) = SEARCH DATA OR
         HIT ANY KEY
Type:    (Function key F7 is located
         on the lower right side of
         the VIC.)
Display: SEARCHING DATA
Display: END OF DATA
Display: (Returns to the main
         menu.)
Display: **MAIN MENU**
         HOW DO YOU WANT ME
         TO LOCATE DATA?
         1..COUNTRY OR CITY
         2..PREFIX
         3..LAT. & LONG.
         4..QUIT
Type:    2<RET>
Display: ENTER PREFIX
         ?
Type:    TT<RET>
Display: CHAD
         LATITUDE 15
         LONGITUDE 19
         BEARING: 50
         DISTANCE FROM OGDEN,
         UTAH
         7437 MILES
         11968 KILOMETERS
         (F7) = SEARCH DATA OR
         HIT ANY KEY
Type:    (Any key.)
Display: (Returns to the main
         menu.)
Display: **MAIN MENU**
         HOW DO YOU WANT ME
         TO LOCATE DATA?
         1..COUNTRY OR CITY
         2..PREFIX
         3..LAT. & LONG.
         4..QUIT
Type:    3<RET>
Display: LATITUDE?
         ?
Type:    -45<RET>
Display: LATITUDE?
         ? -45
         LONGITUDE?
         ?
Type:    120<RET>
Display: LATITUDE?
         ? -45
         LONGITUDE?
         ? 120
         IS YOUR INPUT COR-
         RECT?
         1 = YES 2 = NO
Type:    1<RET>
Display: LATITUDE -45
         LONGITUDE 120
         PREFIX:
         BEARING: 246
         DISTANCE FROM OGDEN,
         UTAH
         9864 MILES
         15874 KILOMETERS
         (F7) = SEARCH DATA OR
         HIT ANY KEY
Type:    (Function key F7.)
Display: I WILL SEARCH MY FILE
         FOR DATA ON LOCATION
         NEAR YOUR COOR-
         DINATE.
         HOW WIDE OF SEARCH
         IN DEGREES?
         ?
Type:    20<RET>
Display: SEARCHING DATA
Display: AUSTRALIA
         LATITUDE -25
         LONGITUDE 130
         PREFIX: VK
         BEARING: 268
         DISTANCE FROM OGDEN,
         UTAH
         8780 MILES
         14130 KILOMETERS
         (F7) = SEARCH DATA OR
         HIT ANY KEY
Type:    (Function key F7.)
Display: SEARCHING DATA
Display: AUSTRALIA
         LATITUDE -25
         LONGITUDE 130
         PREFIX: AX
         BEARING: 268
         DISTANCE FROM OGDEN,
         UTAH
         8780 MILES
         14130 KILOMETERS
         (F7) = SEARCH DATA OR
         HIT ANY KEY
Type:    (Function key F7.)
Display: SEARCHING DATA
Display: END OF DATA
Display: (Program returns to main
         menu.)
```

Sample run.

verts L and B to radians. The remainder of line 610 computes the distance angle, looks at its value, and checks to see if it is positive. If P2 is less than 0, 180 is added to its value (line 645).

After P2 is taken care of, the program moves to line 650. Line 650 computes the distance in miles and kilometers. Line 655 computes the bearing angle and converts bearings to degrees rounded to nearest tenth. Lines 670 and 675 determine which quadrant the bearing angle is in and adjust the degrees. Line 680 makes some adjustments to the value of B2. Line 690 makes adjustments to the value of R4. Lines 710 through 865 perform any necessary adjustments to the value of R2, the bearing angle, and send the program to line 900. This is the RETURN statement used to send the program back to the main program after performing the subroutine.

I have not gone into a great deal of explanation of the math routine as the purpose of this article is not to explain the geometry. If you would like a better explanation of this subroutine, I suggest you consult the *ARRL Antenna Handbook* or any other advanced math book.

Conclusion

I hope this program can be of help to some of you. I have used it a lot. I have needed to make some simple changes in the data statements, but I have attempted to keep the program simple enough so that changes can be made easily. I know that this program will have to be updated occasionally. I used the most current information available. Most of the locations are figured to the center of the country, give or take a degree. Most of the small island latitudes and longitudes have been taken to the tenth of a degree to make the data very accurate.

If you find that you do not have the time to type in the program, I will send it to you on tape for the VIC. The cost is $5.00, and I need to know the amount of memory you have. I also have this program for the Apple II Plus and the VIC-20 on disk for $9.00. (Checks should be made out to me at my address, above.) If you do take the time to type it in and run into trouble, write to me describing the problem you are experiencing and I will try to correct it. I know that no program is perfect.

There are many things that can be done to spruce up the program, especially the Apple version. My main goal was to keep it as simple and efficient as possible, but you can have some fun trying to spruce it up a little. You can always add more data as you expand your memory configuration. Have fun and good luck! ■

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73 INTERNATIONAL

Each month, 73 brings you ham radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73: Amateur Radio's Technical Journal, *Pine Street, Peterborough NH 03458, USA, Attn: Jack Burnett.*

AUSTRALIA

Jim Joyce VK3YJ
44 Wren Street
Altona 3018, Victoria
Australia

THE AUSSIE YL

How often we have heard the pileups and QRM disappear when a rare DX station says those magic words "Please stand by—there's a YL calling." Even those persistent callers, jammers, and deliberate QRM merchants who have, unfortunately, become a sad fact of life on amateur radio these days seem to go QRT when the ladies are transmitting. Maybe it is chivalry, or perhaps a mark of respect to these adventurous young ladies who have involved themselves in what was predominantly a male hobby in the early days of amateur radio. Every so often, a YL operator is heard who is a fine example of why we OMs have that respect.

Austine VK3YL

Austine Henry VK3YL is such a young lady. As a life member of the Society of Wireless Pioneers and as a member of 54-years standing with the Wireless Institute of Australia, she has the distinction of having the longest YL membership record. In 1930, Austine was awarded a trophy from the WIA for the best piece of home-brew gear in the local WIA home-brew competition.

1930 was an active year for Austine, as she also became a member of the ARRL on April 14, 1930. She has 30 years of membership in the RSGB, plus she has been a member of NZART over the last few years. Austine has really kept her finger on the pulse of overseas amateur-radio activities. No wonder she has many tales to tell of the good old days in radio.

When she received her first crystal set as a child, she immediately pulled it to pieces to see how it worked, graduating to valve [tube] sets that she made herself, gaining enough expertise to pass her experimental license exam on May 13, 1930. Only the third woman to obtain an amateur license in Australia, Austine became VK3YL.

As there was no commercial gear available for amateurs in those days, Austine learned at an early stage how to get the best out of a home-brew 1-Watt-input transmitter. To get the crystals for her sets, she used to do a tour of the city opticians, getting their broken or rejected quartz lenses, and, if successful, would hurry home with them to grind her own crystals.

With this type of equipment, Austine had her first CW contact into Belgium on September 30, 1931, with Baron de la Rouche ON4HM. To commemorate this contact, the Baron sent her a bronze replica of the Sacred Guardian Monkey of Mons. She also had a successful contact with a South African amateur in the early 1930s, using a UV199 tube fed with dry batteries, with less than 1 Watt of input power, in a portable situation.

Being an adventurous young wisp of a girl, Austine was fond of horseback riding and driving a little sports car, plus riding motor bikes. It was only natural, therefore, to take up flying. On September 6, 1933, she became the first woman admitted to the Royal Australian Air Force Radio Reserve, the training for which included flying around in a Wapiti biplane. This plane, although old, was very solidly constructed and was used extensively to train both pilots and radio operators, with the pilot in the front cockpit and the radio instructor and pupil in the back cockpit. With these cramped conditions, the student virtually had to sit on the instructor's knee (lucky instructor!). The main requirement for flying in these conditions was to stand up when you landed. Otherwise, if the landing was bumpy and you were sitting down, you could crack your skull on all the gear.

Austine was most upset that they would not send her to the war zone as a radio operator in one of the planes, just because she was a woman, but despite other commitments during WWII, she spent a lot of her spare time at the WIA on a volunteer basis, instructing service personnel and others in the art of Morse code. It was not unusual for Austine to take them into her own home for free private tuition so that they could pass their exams.

After WWII, Austine maintained her interest in amateur radio, with a particular interest in DX. One of her most interesting contacts was in 1957 with Michael FO8AP/MM, on the ill-fated Tahiti Nui raft expedition between Tahiti and Chile. This expedition ended up 600 miles short of Chile when the raft broke apart after a week of storms. Michael was using a transceiver with 1 Watt of input power at that time. Can you imagine trying to send SOS, plus your position, on a raft of 20-inch logs that are breaking apart in the middle of the ocean with 30-foot waves pounding down on you? That would definitely take a steady hand on the key.

CW is a mode at which Austine has remained very proficient, proof of this being her entry to the DXCC Honor Roll as the first and only Australian YL to gain this achievement, but this is only one of Austine's many firsts in the field of amateur radio. Up until 25 years ago, Austine was using only a 40-meter Zepp antenna, graduating to a half-wave centerfed dipole, but in the last few years she has upgraded her antenna system to a triband beam. Her transmitters have graduated from home brew, to converted surplus WWII equipment, to these days, when she is using Drake equipment.

Austine Henry VK3YL.

Austine is quite proud of some of her earlier award achievements, some of which are: the first to work WAC-YL, Certificate No. 22 for the YL-DXCC from Canada (hand-printed in gold), and from Heather Mitchell VK3AZU (the designer of the Alara award), a certificate for being the first VK YL to receive this award.

Those are only a few of the various awards Austine has to her credit. She is also a foundation member of Yasme, winning Certificate No. 7 in the prestigious Yasme award, one in front of the famous Don Wallace W6AM who got Certificate No. 8 in 1980.

What more can be said about a woman who, after 54 years of amateur-radio operating, is still heard in the pileups, keeping her operating techniques in CW and SSB sharp, just in case there comes on the air one of the four countries she still needs to have worked the lot.

88s, Austine!

CB RADIO

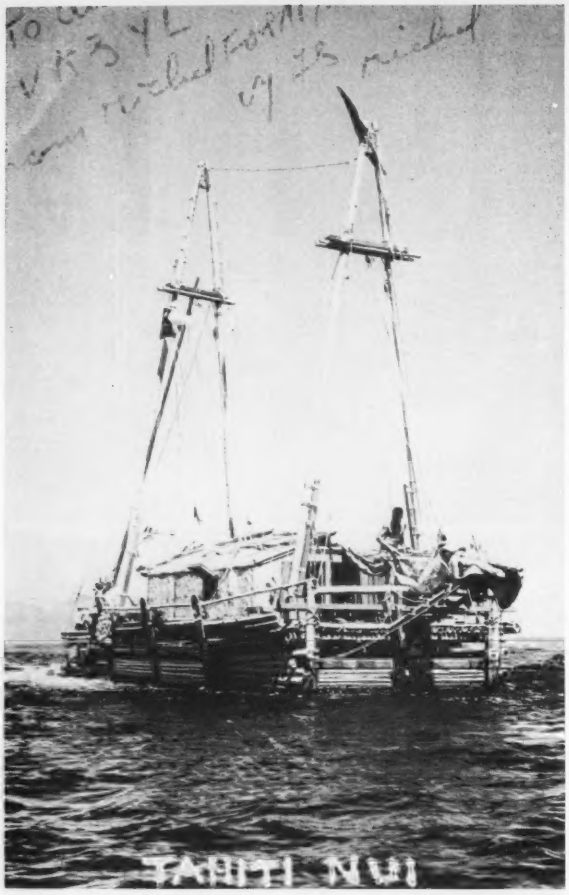
CB radio has been both a blessing and a curse to amateur radio in Australia. It started with the truckers in the Blue Mountains of New South Wales (VK2), where it was put to good use as a safety device on the narrow, steep hills, but with the showing of the film *Convoy*, all of the rest of Australia became aware of what was to become a loss of 27 MHz to amateur radio in Australia and a headache for our Department of Communications, but a boom for amateur radio.

With the interest created by CB, it did not take long for people to realize that with ever-increasing chaos on 27 MHz, there had to be something better in the field of communications. It is here that both the Wireless Institute of Australia and the DOC, to their credit, got together with the result being a Novice class of amateur license.

To pass this, you had to answer a 50-question, multi-choice paper on relatively easy electrical laws, operating procedures, and basic radio theory. You also had a 30-question paper on rules and regulations (multi-choice). Your CW test was at 5 wpm, send and receive.

If you passed this exam, you were allowed to operate both SSB and CW on a section of 10, 15, and 80 meters, with a maximum power output of 30 Watts PEP. A few countries have been thinking of also

Point Cook, 1933: The Wapiti in which Austine 3YL/3D6 made her flying debut. (Picture given to her by Jim 3NY/3B6.)



The card sent to Austine by Michael FO8AP/MM who, here in 1957, is looking over the rear of his raft.

introducing a similar Novice-class license and, going by the upsurge in amateur radio in Australia, it would be a good thing, as up until the advent of CB and the Novice-class license, the amateur-radio scene in Australia was virtually stagnant.

As an example, going by WIA membership (which has remained at approximately 60% of the total amateur population), from 1963, with 3,500 members, to 1973, there was an increase of 1,000 (28%), but by 1983, with the advent of CB and the Novice license, there was an unprecedented upsurge in new amateurs and membership was 8,500. That represented a 53% 10-year increase, nearly twice that of the previous 10-year period.

However, like everything else in life, you get nothing for nothing. The cost to the amateurs so far has been the loss of the 27-MHz band and, with retailers down here now quite blatantly advertising CBs with a frequency coverage of 26.965 to 28.805 MHz in 5-KHz steps, how long before we also lose 28 MHz?

"It will never happen," I hear the old-timers saying into their 807s, but the CB fraternity in Australia now legally has 40 channels and no restrictions on antennas (six-element beams are quite common) plus freely-advertised linear amplifiers of up to 600 Watts output for 27 MHz. What happened to the legal limit of 12 Watts PEP for CB? The CB operators in Australia also enjoy a section of the UHF band quite legally, with access to repeaters and, believe it or not, freely-advertised linear amps for UHF.

I would not be surprised if in the near future, due to our archaic import and resale laws in Australia, 14-MHz sets appear for resale, as it is quite legal to import and retail any type of equipment providing it is not dangerous to health or does not interfere with emergency services. A CB operator can quite legally buy himself an FT-902DM with an FL2100Z linear, connect it to his 6-element monobander and, unless he causes interference (with a resulting visit from the overworked DOC investigator), can operate illegally to his heart's content.

That is the negative—but worth thinking about—side of the CB input to amateur radio in Australia.

The positive side has many pluses. It is not unusual to hear on the CW section of the Novice band a couple of Novices rattling away on CW at 20 wpm; some are even faster. These speed merchants on the key usually are ex-service signal personnel or postoffice telegraphists who, over the years, have forgotten all about radio but, with the advent of the Novice license, have found that with a little study on solid-state basics, they can get back into the communications field. As most of these gentlemen are now retired, they tend to study and get their full-call license. The result is that many ex-signal ops of the various services during WWII now get on the air with their own net frequencies to chew the fat about old times.

We also have the lifetime SWL who could not pass the previous license test for the full call, but now, due to the Novice license, with a bit of study is able to transmit to stations he has logged as an SWL over many years.

In conclusion, due to the upsurge of CB radio we have had both gains and losses, and only time will tell if it has been good for amateur radio in Australia. I do personally feel, however, that with the advent of the latest toy, namely a cordless telephone with a 9-km range (together with other as-yet-untested frequency damaging devices being imported into this country), we may suffer an unprecedented interference problem on the amateur bands and commercial frequencies.

The extent of such interference could be such that the Department of Communications (DOC) may have some difficulty in controlling it, as in past instances with 27 MHz. There is some ray of hope, however, since at this very moment a new Act of Parliament (Radio Communications Bill) is in the final stages of debate and is expected to pass the Senate shortly. When this occurs, the Department of Communications will have little difficulty in obtaining a prosecution against illegal operations, since the mere possession of transmitting equipment without a license or just cause will be an indictable offense.

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PR7	PO Box 168, 58000 Joao Pessoa, PB
PR8	PO Box 372, 65000 Sao Luiz, MA
PS7	PO Box 251, 59000 Natal, RN
PS8	PO Box 137, 64000 Teresina, PI
PT2	PO Box 07/0004, 70200 Brasilia, DF
PT7	PO Box 975, 60000 Fortaleza, CE
PT8	PO Box 149, 69900 Rio Branco, AC
PT9	PO Box 008, 79100 Campo Grande, MS
PV8	PO Box 148, 69300 Boa Vista, RR
PW8	PO Box 84, 78900 Porto Velho, RO
PY1	PO Box 58, 20001 Rio de Janeiro, RJ
PY2	PO Box 22, 01000 Sao Paulo, SP
PY3	PO Box 2180, 90000 Porto Alegre, RS
PY4	PO Box 314, 30000 Belo Horizonte, MG
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QSL BUREAU

The Brazilian amateurs who are members of the League (LABRE) may use the QSL Bureau to send and receive their QSL cards, free of charge. In this way, each QSL Bureau handles thousands of cards monthly and it is easy for us to spread out our QSL cards around the world. Inside Brazil, the service is very good and fast. The QSL travels from one Bureau to another in only one day.

Working so well, it is not difficult to receive a Brazilian card via the Bureau after a short time. Foreign amateurs may also send their QSL cards to Brazil, addressing them to the QSL Bureau when they are not able to find out the right direction. The QSL Bureaus are located in all capital cities (see box). The main one is in Brasilia, the Federal District.

RESULTS OF THE HUNTING LIONS ON THE AIR CONTEST—1983

The principal objective of this contest is to create and foster a spirit of international understanding and cooperation among Lions and ham-radio operators through worldwide communications. The contest is held in tribute to the birthday of Melvin Jones, the founder of Lionism. It is sponsored by Lions and coordinated by the Rio de Janeiro (Arpoador) Lions Club.

About 13,000 contacts were made among stations located in 114 countries. In the Single-Operator Class—Phone, the winner was VK6NO, followed by K7OX, ZD8JD, ZL1SZ, and PY1BPE. In the Single-Operator Class—CW, the highest score was for the very well-known operator Tim Chen BV2A, followed by PY2ASV, OH6OC, K4EBT, and OH9SV. For the Club Station Class—Phone, the winner was GJ3DVC, the Jersey Amateur Radio Society, and in CW, CT1ARS, the Southern Radioamateur Association of Portugal.

MCG AWARD

Sponsored by the Morse Clube Gaucho (CW Group), the MCG Award is available to all licensed amateurs for confirmed contacts with 5 (five) different MCG members. Contacts must have been made after May 1, 1980, on any amateur band, only two-way CW mode. No QSLs. Send GCR list of stations worked (call, date, time, band, mode, and report) and 5 IRCs for mailing expenses to: MCG Bureau, PO Box 2180, 90000 Porto Alegre, RS, Brazil.

For SWLs, the same rules apply.

MCG members: PY3AVF, PY3AZL, PY3AKS, PY3AZ, PY3AO, PY3BC,

PY3BYC, PY3BVI, PY3BOG, PY3BCD, PY3CMH, PY3CJI, PY3CFD, PY3CMZ, PY3CKI, PY3CNY, PY3COR, PY3CGJ, PY3CGW, PY3CEM, PY3FMC, PY3FJ, PY3FS, PY3HR, PY3HS, PY3JJ, PY3LIM, PY3MU, PY3OH, PY3OS, PY3PO, PY3PR, PY3SM, PY3TT, and PY3ZZ.

THREE STARS AWARD

Sponsored by the David Barros Scout Group, GREDB, the Three Stars Award is available to all licensed amateurs for confirmed contacts with 2 (two) GREDB members plus a contact with PY1EDB (the group station) and contacts with three different Brazilian prefixes. Contacts must have been made after January 1, 1982, on any amateur band and any mode. No QSLs. Send GCR list of stations worked (call, date, time, band, mode, and report), your personal QSL, and 10 IRCs for mailing expenses to: GREDB, PO Box 20033, 21022 Rio de Janeiro, RJ, Brazil.

GREDB members: PY1s ABK, AFA, AMG, ATR, AVV, AWA, AZF, BCZ, BON, BGI, BLG, BM, BPU, BUF, BV, BVB, CBG, CBW, CC, CCD, CCE, CCK, CCO, CDA, CGB, CKL, CKV, CKY, CLI, COA, CPC, CQV, CIP, DCO, DED, DIA, DWP, DMX, EEX, ELU, ENN, EHD, ER, FP, IP, IR, NE, RI, TBG, TBW, TCI, TFU, TFQ, TFW, THH, TNV, TOM, TPH, TPW, TTF, TTH, TUP, TUQ, UBX, UVP, USU, VBR, VIZ, VKK, VOP, VTU, VXO, WFR, WHO, WIO, WIR, WTA, XHK, XRI, XRX, XXP, YDQ, YJD, PY2BI, and PY4BCF.

JUBILEE OF LABRE

On February 2, 1984, the Brazilian Amateur Radio League (LABRE) will celebrate its 50th anniversary. The IV Brazilian Convention joining amateurs of the whole country will be held in Brasilia, the Federal District, for this purpose.

Besides the meetings and parties, etc., the convention will sponsor a lot of tourist happenings for those who haven't had the opportunity to know the capital city yet. In collaboration with LABRE, three excellent hotels will offer special prices for the amateurs.

Valmir J. Pereira PT2FA, President of LABRE, will do all he can to promote unforgettable events. For further information, please write to LABRE, PO Box 070004, 70000 Brasilia, DF, Brazil.

QSP-DX

To provide information for Brazilian DXers, Luc PT7WA with a group of PT7 friends established the *QSP-DX Bulletin*. In the bulletin, written in Portuguese, we can find details about DXpeditions, contests, rare countries on the air, QSL information, and everything interesting to the DXer, especially the newcomer.

The bulletin is bimonthly; after the second issue, about 150 amateurs had already subscribed. The subscription fee is only enough to pay the printing and mailing expenses. If you want to provide the bulletin with any DX information, please write to *QSP-DX*, Rua Ageu Romero 83, 60000 Fortaleza, CE, Brazil.

CWMG AWARD

Sponsored by the Minas Gerais CW Club (CW Group), the CWMG Award is available to all licensed amateurs for confirmed contacts with 5 (five) different CWMG members. Contacts must have been made after May 1, 1978, on any amateur band, only two-way CW mode. No QSLs. Send GCR list of stations worked (call, date, time, band, mode, and report) and 6 IRCs for mailing expenses to: CWMG Award, PO Box 314, 30000 Belo Horizonte, MG, Brazil.

CWMG members: PY4AAF, PY4ABI, PY4ACV, PY4AD, PY4ADW, PY4AFP, PY4AH, PY4AM, PY4AP, PY4APF, PY4AQL, PY4AQM, PY4AUB, PY4AUN, PY4BAT, PY4BCR, PY4BLR, PY4BMO, PY4BZS, PY4BW, PY4CMG, PY4CO, PY4DD, PY4DM, PY4DS, PY4DT, PY4HR, PY4IF, PY4IR, PY4IS, PY4JD, PY4KS, PY4LB, PY4LJ, PY4MA, PY4MG, PY4OA, PY4OD, PY4OP, PY4PR, PY4RA, PY4RL, PY4SM, PY4SS, PY4ST, PY4WG, PY4WAS, PY4XUP, PY4ZI, and PP2ZI.

GMPR AWARD

Sponsored by the GMPR Group of CW, the GMPR Award is available to all licensed amateurs for confirmed contacts with 6 (six) different GMPR members. Contacts must have been made after July 30, 1982, on any amateur band, only two-way CW mode. No QSLs. Send GCR list of stations worked (call, date, time, band, mode, and report), your personal QSL, and 10 IRCs for mailing expenses to: GMPR Award, PO Box 4143, 80000 Curitiba, PR, Brazil.

For SWLs, the same rules apply.

Endorsements: Besides the six GMPR members, confirmed contacts with 2, 3, 4, or 5 stations located in the State of Parana (PY5) earn an endorsement. It is not necessary that they be GMPR members.

GMPR members: PY5AFC, PY5AFD, PY5AGX, PY5AGZ, PY5AIO, PY5AIW, PY5AKX, PY5ALF, PY5AVR, PY5BYC, PY5CIG, PY5CL, PY5CMS, PY5FI, PY5GI, PY5GJ, PY5HF, PY5IG, PY5IJ, PY5JL, PY5LA, PY5NGA, PY5OE, PY5PMR, PY5AJE, PY5RT, PY5VX, PY5XFR, PY5ZW, and PY1BVY.

de PY1APS

1983 WORLDWIDE SOUTH AMERICA CW CONTEST

Sponsored by the Brazilian magazine, *Eletronica Popular*, and supervised by the Argentina GACW group and the Brazilian PPC Picapau Carioca, the 1983 WWSA CW Contest was a hit, considering it's only in its second year.

Little by little, slow but sure, hams are coming to this contest, the only one gathering South American countries and spreading QSOs all over the world during 24 hours of operation, from 1500 UTC Saturday to 1500 UTC Sunday, the last weekend in June.

Not only the fun of the party, but also this FB opportunity of meeting bunches of still rare South American calls and special prefixes is raising DXers' interest for this unique WWSA CW Contest.

Argentina's, Uruguay's, and Brazil's groups and DXers are trying hard to bring more and more South American countries to the fun, thus aiming at increasing the interest of hams in other continents in the WWSA CW Contest.

We sure hope to meet many of you at the 1984 WWSA CW Contest, to take place from Saturday, June 9, 1500 UTC to Sunday, June 10, 1500 UTC.

1983 WWSA CW CONTEST

DX STATIONS

3.5 MHz	YO3HP	
7 MHz	LZ1GC	850
	YO3CD	600
	Y51XE	260
14 MHz	JH3DPB	2,184
	W4VQ	1,276
	HB9BPP	864
21 MHz	OK2QX	2,728
	EI3DP	1,600
	Y32KE	1,122
28 MHz	VE1BNN	1,254
Multiband	W3GM	27,710
	YU4YA	18,492
	LZ2DB	14,384
Multi-op	LZ1KDP	27,600
	SP9KTE	7,296
	OK3KEX	5,760

Continental Winners

Asia	JA1BX	2,132
Europe	YU4YA	18,492
North Am.	W3GM	27,710
South Am.	CX7BY	266,304

Continental Leaders

Multiband/Multi-op

Europe	LZ1KDP	27,600
South Am.	PY1EDB	650

SOUTH AMERICAN STATIONS

3.5 MHz	CX8DT	1,296
	PY2RNJ	84
	PY2OHJ	8
7 MHz	CX5AO	22,160
	PY3CFD	2,730
	PY5AAZ	280
14 MHz	YV5HUJ	60,588
	PY5MR	3,312
	PY2DRP	2,604
21 MHz	PY1DFF	37,904
	LU4FC	32,472
	PY1BVY	31,044
28 MHz	PY1HQ	15,984
	PY3XYZ/PP2	10,740
	PY1DPP	2,840
Multiband	CX7BY	266,304
	LU9EIE	222,222
	PT9EJ	87,720
Multi-op	PY1EDB	650

CANADA

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The Department of Communications in Ottawa recently lifted the requirements for logging in Canada. For some amateurs, this action means nothing, as I am sure better than half of the amateurs across Canada never logged their activities anyway. Rarely, if ever, was this requirement checked. It should be remembered, however, that logging is a form of self-defense in that you can always refer to your log should you be accused of an infraction of the regs.

The Canadian Amateur Radio Federation and the Canadian Division ARRL (CRRL) met at Cobourg, Ontario, during the summer to finalize a joint submission to the DOC regarding TRC24 (the requirements for examination for the amateur service). Between the two organizations, every area of importance was covered.

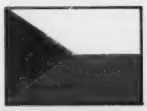
Each group submitted its own proposal and it seems that the DOC was open to these suggestions. The resultant redrafting of TRC24 should be common knowledge by this time. A great deal of credit for this work can be shared by many parties. Art Blick VE3AHU of Kingston, Ontario, the CARF General Manager, Ron Walsh VE3IDW, also of Kingston and one of CARF's Vice-Presidents, CRRL president Tom Atkins VE3CDM of Toronto, and ARRL Canadian Division Vice-Director Harry MacLean VE3GRO of London, Ontario, carried the amateur flame in a cooperative and constructive manner. The DOC was represented by G. Wintermeyer from the head office in Ottawa.

The 1983 CARF National Symposium was held in Halifax, Nova Scotia, during the middle of October this year. For those of you who don't know what this is: Amateurs from across Canada get together once a year (en masse) to provide direct input to the DOC on matters relating to the amateur service in Canada. The number of people attending these conferences is not usually great since most groups of amateurs provide only written submissions to be read and considered. This is far less expensive than sending a representative across the country for a one-day event. Full details will be provided in a future column.

A while back, a group of white caners in Toronto, Ontario, organized a reception to express appreciation for the work of an individual. Bill Choat VE3CO was stepping down as chief of the CNIB amateur-radio operation in Toronto, and some of his charges wanted him to be recognized for his efforts in the past. Bill has been in charge of this group for many years now, and through his efforts and the efforts of others, many white caners were given the opportunity to experience the joys of amateur radio, despite their handicap. Nearly 100 blind and sighted amateurs participated and I think Bill went away with the feeling that all was right with the world.

Canada's national amateur-radio journal, *TCA*, has been plagued with postal problems for several years now. Recently, an Ontario amateur wrote the Minister responsible for Canada Post, complaining of the late delivery of his July/August copy. Some time later, I, as editor of *TCA*, received a call from a Canada Post employee who wanted to know when the magazine had been mailed. When the caller discovered that more than three weeks had passed between mailing and delivery, she became very defensive and tried to leave me with the impression that the system was not only better than it was, but would get better as time went by. She would not elaborate on what amount of time would pass before this event, but I got the distinct impression that it would coincide with the "second coming," or at least the blooming of century plants.

Speaking of *TCA*, the November issue was mailed to every amateur in Canada as part of a membership drive on behalf of CARF. Canadian amateurs living in the USA did not receive a copy due to postal limitations and costs. If you would like to receive one, please write to the Canadian Amateur Radio Federation, PO Box 356 Station, Kingston, Ontario, Canada K1P 5W7. Depending on numbers remaining, we may be able to send you a copy. Enclose $1.50 to cover postage and handling costs (mostly postage). You will notice that this is also the cover price, so it balances out.



CZECHOSLOVAKIA

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I have 25 years. I am a member of Radioclub OK3KFO in Topol'cany and have been an active amateur for 13 years. My call is OK3CMZ. I hope that you *73*

magazine readers will enjoy the information I send. Please excuse that I am self-taught in the English language.

I should like to inform readers of *73* about radio-amateur life in Czechoslovakia. In Czechoslovakia, we have approximately four thousand licensed radio amateurs, not counting 1500 SWLs. The most activity is in DX work; there is less activity with contests.

Czechoslovakia is a little republic. One day a week—Thursday—OK3KAB in Bratislava (capital city of Slovakia) broadcasts about all radio-amateur activity. The program is popular because it sends quality information.

Approximately 10% of the people work 144 MHz and 433 MHz. Over the last 10 years, Czechoslovakian microwave stations have reached good places in international contests. Other OKs are working over satellites, and approximately 10 work EME. Tens of thousands are devoted to constructing various mechanisms.

I know my first column is not very interesting so I would like readers of *73* to ask for what they would like to know about activity in Czechoslovakia.

DOMINICAN REPUBLIC

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Some of you have probably worked Dominican (HI) stations in the 20- or 15-meter band but have been less fortunate in contacting the other bands and getting QSLs.

To contact and get QSLs from HI is not an easy task, and exotic bands such as 6 and 160 meters seem to be "Mission Impossible," but even so, there are possibilities.

To be successful, you first have to know which station you're looking for, at what time you should search for it, and last, be lucky enough to find it. Once you have made your contact, it will be easy for you to receive the QSL because there are few people who work on 6 and 160 and those who do confirm on time.

In the 6-meter band we have key people such as Waldo HI8WPC and Domingo HI8DAF. The same applies in the 160-meter band with Jose HI8JAG, Mike HI8MRF, and Virgilio HI8VMA. These stations generally work from 0000 GMT to 0800 GMT. Within these times, schedules could be arranged by sending the above-mentioned stations a note to Box 1157, Radio Club Dominicano, Santo Domingo, Dominican Republic.

Another difficult HI contact is the one via satellite. The only representative there is Jorge HI8JAF, and he is on the radio as long as his business activities allow him. Jorge is one who loves that particular type of communication, and on the first DX-pedition to Beata Island (HI1RCD) in 1979, he made some contacts there. If any of you are interested in this particular kind of communication with an HI, you could write for additional information to: Jorge Abbott HI8JAF, Rafael F. Bonely #8, Ens. Evaristo Morales, Santo Domingo, Dominican Republic. I am sure he will fix a schedule and the QSL will get to you safely.

Another contact mode considered unobtainable in HI is CW. In the Dominican Republic, anybody who expects to get a ham-radio license is supposed to go through a CW exam. However, this is only in theory, because there are no effective mechanisms to guarantee that it will happen. For those 1500 that have already received their licenses, there's nothing to be done. The practice of CW is restricted to fewer than 1% of those listed in the *Callbook*; nevertheless, among them there are some excellent operators.

In CW, we have two young operators who are very good, Julito HI3JEI and Carlos HI8CPT, plus the hard-working veterans HI3PC, HI8LC, HI8OMB, HI8KW, HI8RPD, and HI8DAF.

The Dominican Radio Club frequently offers CW courses to its members and guests; thus it maintains a live spirit in this mode even though it has lost popularity in our country.

Can you get a contact with a YL in the Dominican Republic? For chatting there may be some, but for QSLs and DXs, there are very few. However, there are some surprises: Charo HI8RPD enjoys DX, works regularly, works with CW, and sends QSLs besides. You can also find Azilde HI7HHH or Maritza HI8MSS, and both will send their QSLs gladly.

Undoubtedly the language barrier limits many HI ham operators, so communication is made more difficult. On the other hand, the small active group in DX knows English well enough to obtain their contacts. Abed HI8IH and Victor HI8VAT look frequently for DX on 40 and 80 meters, and the same goes for an active group in the HI3 zone with Antonio HI3AMF leading them.

It is my hope that, with these hints, it will be easier to get HI stations and your QSLs, too. Also, for five years, the Dominican Radio Club has had a national campaign among ham-radio operators to stimulate the sending of QSLs, and the results have been positive. The annual average has increased more than 70%. The QSL Bureau is managed by the Dominican Radio Club and has worked efficiently for many years.

Before closing, I'd like to add that we know how important QSLs are and how much they mean, especially to DXers. We will be glad to help you find confirmation of a contact which was made during the past five years; we will help all we can.

ECUADOR

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July 23 and 24 last year will be remembered by the technical department of the Guayaquil Radio Club as historical. They were a Saturday and Sunday. What did we do?

Well, a party of amateurs, HC2NW, HC2OL, HC2IH, HC2LU, HC2NS, and HC2KY, went up Chimborazo, the highest volcano in Ecuador (6,310 meters—18,930 feet), in order to install a 40-meter link in a 2-meter repeater. The idea became reality after a mere four weeks of planning. All Saturday they kept working until around 1700 hours, which is late for the altitude at the repeater (4,400–4,500 meters—13,500 feet). They did a lot of testing, and now it is giving the best results.

Now, from all the coast part of our country, it is possible to access the repeater from your car and get through to 40 meters. The frequency is 7080 kHz, and you'd better look for Ecuador so you can test the 40-meter/2-meter link.

Getting there was a lot of fun (troubles + adventures = fun). Saturday evening, HC2IH's car got stuck in mud and snow, and on the way out, the steel bar that keeps the front wheels aligned broke loose. Well, at that time and in that place, all that was left to do was sleep and wait until the next day. The hero (?) who slept in the car (with the engine running, the heater on) was HC2LU. The temperature was below freezing (0° C), so the car didn't even heat up.

Anyway, on Sunday was a tougher test: to try to reach the members of an expedition that was on the Irazu volcano, at 4,250 meters, in San Jose, Costa Rica (TI)! A lot of arrangements had been made through the goodwill and work of TI2KC and HC2EC. At those heights, the wind, the temperature, etc., were a challenge; the people at both places did a good job preparing for the contacts.

In San Jose, they were ready with 10,000 Watts FM, SSB, and HF. The link in 40 meters was not working due to the lack of a better antenna with the Chimborazo expedition, so HC2PP was the guy that linked them all together via 2 meters and 40 meters. While everybody was getting ready, many amateurs from all places were very helpful in clearing frequencies and giving good advice.

Exactly at 12:23 (HC)—1723 GMT—on July 24th—the Irazu expedition transmitted on 146.500 MHz with no results. After a few tries on FM and SSB on 2 meters, there were no positive contacts; the same was true with the Chimborazo expedition. Around 1800 GMT, we tried through a repeater situated where the Ecuadorian expedition was, and we heard three times that the repeater was activated. No modulation, but it gave us a nice feeling of something!

Anyway, after two hours, all the equipment and gear were disassembled. Our president, HC2KC, and the president of the Costa Rica Radio Club (TI2KC) interchanged greetings and thanks for all the efforts, and both confirmed that in the near future, with more testing, the link is going to work.

Well, they decided to try more testing in a new place, Cerro de la Meurte (Death Mountain), that is believed to be better. All amateurs who participated were not frustrated; we believe it is going to take some more coordinated efforts, and we are positive about out next results.

There is another project, and that is to try to put a repeater on a small island that belongs to Panama. Why? Because HC2NS, on old sailor, did access the repeater 146.895 (–) from that point, which is more than 200 nautical miles from the repeater, at 4,400–4,500 meters above sea level!

I will keep you informed, and we *are* going to make it!

FRANCE

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I would like to say some words about the first French association (REF—Reseau des Emetteurs Francais), founded in 1925. Some years ago, the situation was rather confused, but thanks to the work of a new and very good team, it is now completely reversed. We see that REF again has a fine future! Furthermore, dealings with the second association (URC—Union des Radio-Clubs) are more hearty than formerly. At the beginning, the two were at daggers drawn, but now they cooperate in facing difficulties (new license examinations, UHF, regulations, etc.).

Some hams and SWLs are getting in trouble: They have bought general-coverage receivers, called "scanners," which unfortunately are illegal here. As a matter of fact, people are brought up for trial and convicted (with a fine and receiver confiscation). However, REF has lodged an appeal. The law amounts to saying that French hams have the right to listen only to the amateur allocations. No comment.

Once again, we have heard on the air that tickets for part of the 28-MHz band would be granted without a Morse-code test. Actually, this is utterly false. It is a CB rumor which till now officials have turned down. On the other hand, new regulations for 27 MHz are generous: 40 channels, 4 Watts SSB (peak), 4 Watts FM, 1 Watt AM, and the possibilities of 6-dB-gain antennas. It goes without saying that CBers are not yet satisfied. This band is so busy that some people escape to the 6-MHz band.

65-year-old hams without Morse-code knowledge can ask again for the full licenses (F6) without taking the 10-wpm test. Since the beginning of this year and the new license regulations, this gift had been forgotten.

A new ham magazine is born: *Megahertz*. Covering microcomputers, astronomy, private FM broadcast, and of course all ham activities, this third French ham magazine looks promising and means that amateur radio in France enjoys good health!

GREAT BRITAIN

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One of my particular interests is RTTY (WAC and some 70 countries worked to date). The RTTY enthusiast over here is well looked after by BARTG, the British Amateur Radio Teletype Group, which promotes RTTY activities, contests, and awards, advises on RTTY matters, transmits a RTTY bulletin, and publishes the BARTG newsletter. (Readers interested in joining BARTG should write to the Membership Secretary, Mrs. T. Crane, Greta Woods, Bromley Road, Ardleigh, Colchester C07 7SF, England—dues are about US$5 per year.)

A recent BARTG survey reveals that about 65% of its members still use traditional clanking teletypes for their RTTY with the Creed line (444, 54, 7, etc.) being by far the most popular. Even more surprising, to me at least, was the comment that a number of stations have 4 or 5 such machines in constant use. I am not sure that the floor of my shack (in the house loft) would stand the weight of even one such machine. I am sure though that the rest of the family would rebel at the noise from a traditional teletype.

Something like 34% of BARTG members use electronic RTTY systems or home computers (with 5% using AMTOR). Commercial units are best represented by the Microwave modules line although Hal has captured about 13% of the UK market.

With my own all-electronic RTTY station (Dovetron terminal unit, Extel VDU, and ma-

Continued on page 116

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Convert the Oddball Hy-Gain Board

Some of these boards have two crystals and some have three. Now you can put them all on 10-meter FM.

Recently, the popularity of the Hy-Gain surplus boards has been tremendous. However, there are several types of these boards on the market today, and each type requires a different method of attack. The 3-crystal model with the PLL-02 phase-locked-loop chip has been well discussed in a previous article.[1] The board I am going to discuss is the board with the part number PTBM051AOX, available from Surplus Electronics Corp.[2]

The major differences with this board compared with the other Hy-Gain boards is the 2-crystal approach. The third offset crystal has been eliminated so that all frequencies are generated by the 10.24-MHz reference crystal. The other crystal, 10.695, is used to offset the synthesizer/mixer output by the amount of the receiver first i-f.

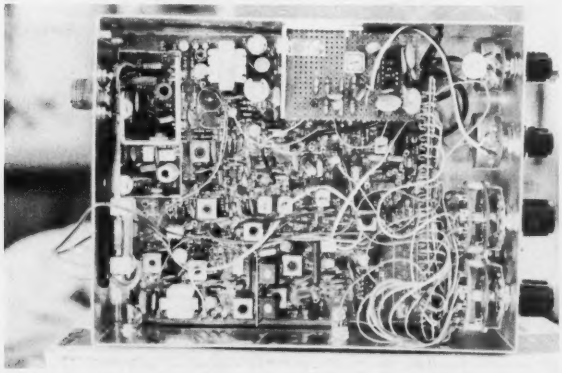
This presents three problems. First, with this mixing process, the PLL programming is upside down. That is, if you increase the divide-by-N, the frequency goes down, and since a prerequisite of any of my 10-meter FM conversions is a direct frequency readout system, this makes it a bit difficult. The second problem is that you cannot decide what divide-by-N equals which frequency. This is decided for you. The third problem is the odd 5-kHz output frequency. By that I mean that when this conversion is made, we want the operating frequency of the transceiver to be 29.600 MHz, not 29.595 or 29.605 MHz. So a change will have to be made there. All that is done here is to raise the reference frequency slightly, making each channel a few Hertz more than 10-kHz channel spacing.

Circuit Description

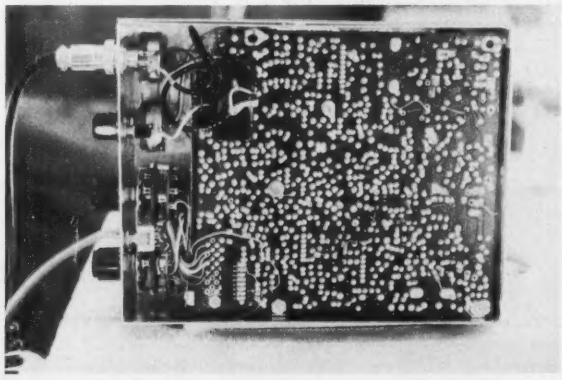
There will be three added circuits to the original board. Those are the FM detector/squelch board, the modulator board, and the frequency-selector board.

. The FM detector/squelch board (see Fig. 1) consists of one IC and two transistors and is designed to interface the CB board easily. The 2111 IC is a common IC that is used in television receivers and scanners. This chip provides the i-f limiting and the quadrature detection necessary for FM detection. Transformer T01 is tuned to 455 kHz, and the transformer can be obtained from an old transistor radio. The primary winding is used.

The noise to operate the squelch is taken from pin 1 of the IC which is before the de-emphasis capacitor, C01. The noise is filtered and amplified by the two-



A top view of the radio. Notice the mounting of the three added boards.



This is a bottom look with the cover removed. Next to the piece of electrical tape is the connection to the input of the FM detector/squelch board.

transistor circuit, and the output is applied to the base of the audio switch in the receiver (Q13). The input at C02 is taken from the secondary of the last i-f transformer through a short length of RG-174 coax. The volume and squelch pots are front-panel-mounted.

The easiest board to construct is the modulator board (see Fig. 2). The input is taken from the audio output chip in the receiver. On receive, this line is shorted to ground, causing the modulator to be disabled. The gain pot provides audio voltage to the diode clipper, which clips the audio peaks to approximately 1.2 volts p-p. The deviation pot selects which portion of this clipped audio is to be applied to the vco. This provides for direct FMing of the transmitter.

The third board is the frequency selector board. There are three controls on the front panel. There are two single-pole, 10-position switches, 29.50–29.59 and 29.60–29.60 MHz. There is also a three-position toggle switch (SPDT C-O), used so that either 29.50–29.59 MHz simplex, 29.60–29.69 MHz simplex, or 29.50–29.59 transmit and 29.60–29.69 MHz receive can be selected. The last combination is for repeater offsets.

A look at the frequency selector board circuit (see Fig. 3) shows a diode matrix and a two-transistor circuit. The two transistors select which of the two single-pole, 10-position switches gets the 5 volts. The switch that gets the 5 volts is the switch that is active for frequency selection.

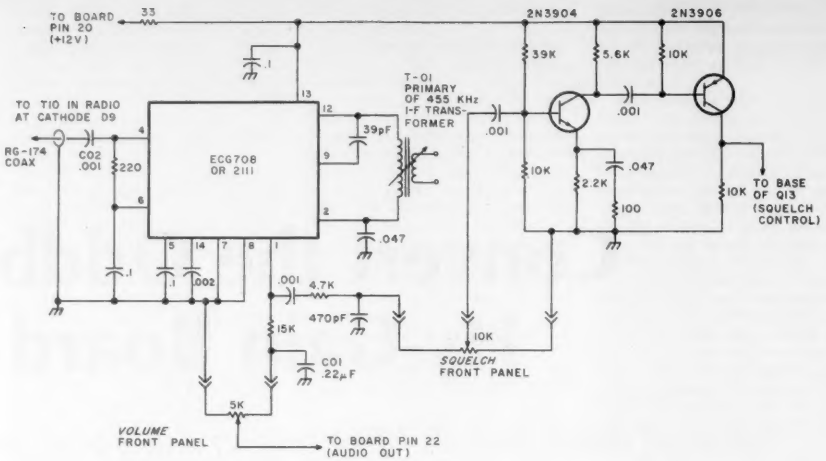


Fig. 1. FM detector/squelch board. Capacitors are in uF, 25 volts disc ceramic unless otherwise noted. Resistors are ¼ W.

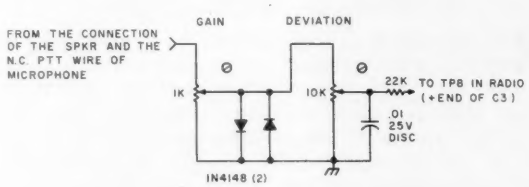


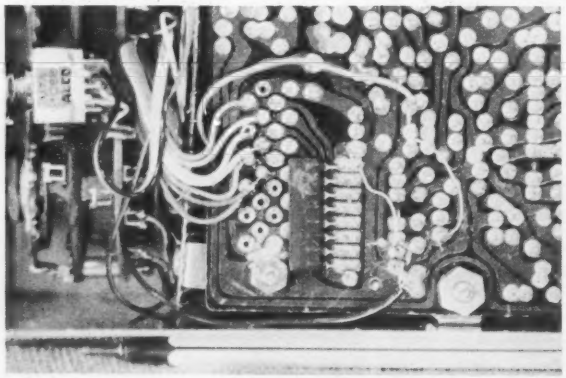
Fig. 2. FM modulator board.

The steering for this circuit comes from board pin 12, which is operated by the PTT. This pin is high on receive and low on transmit. This is what happens: With the SPDT C-O switch in the center-off position, the 29.60–29.69 selector gets the 5 volts on receive and the 29.50–29.59 on transmit. By switching the SPDT C-O switch to one of the two other positions, the switching from pin 12 is disabled and locks up to a certain 10-position switch in transmit and receive.

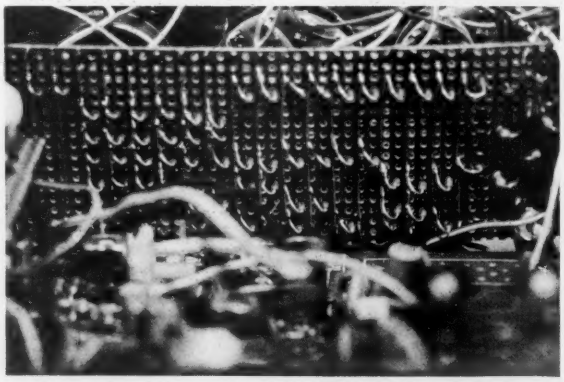
The diode matrix programs the PLL-02 IC in the radio. On the right of the frequency selector circuit are the binary weight values for the PLL-02 IC, along with the pins to which the wires must be connected. Along the top are listed the total binary weighting values for the various switch positions. Next to the switch positions are the last two digits of the operating frequency. The 5 volts to operate this circuit is brought from a 5-volt regulator which is part of the Hy-Gain board.

Construction

First, a few modifications to the Hy-Gain board must be done. Connect board pins 38 and 39 together. Re-



A close-up of the PLL-02 IC. The thick wires go to the frequency selector board, and the thin wires are the circuit changes made to the PLL-02 circuit.



A close-up view of the frequency selector board, showing how the diodes are installed and the 20 bare wires that go to the selector switches.

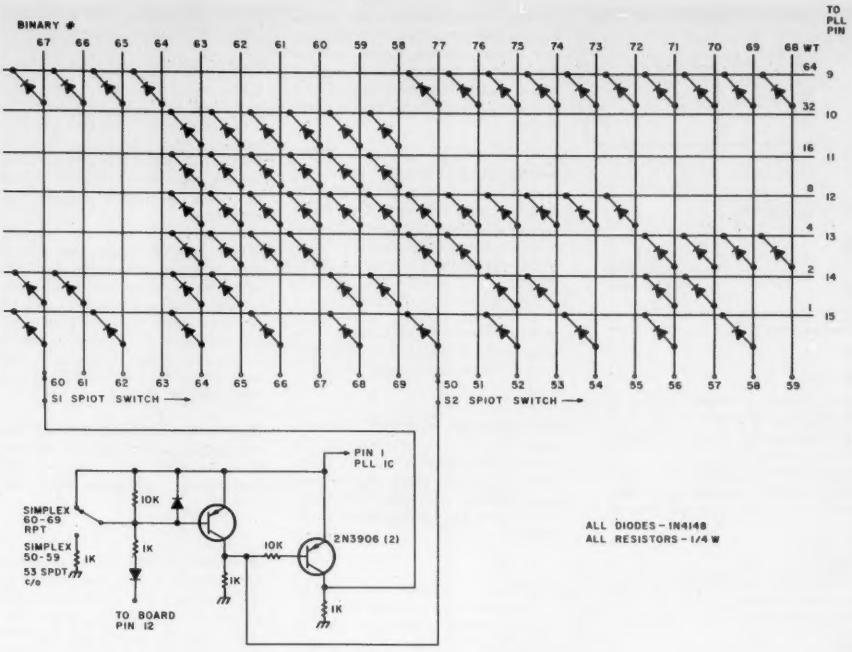


Fig. 3. Frequency selector board.

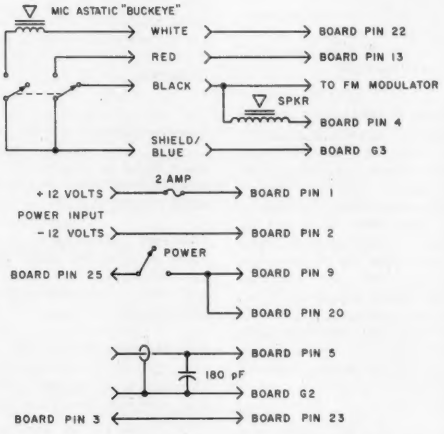


Fig. 4. Other hookups.

move R69, R71, D13, RV2, and C12. Connect a wire from board pin 20 to where the cathode of D13 was. To modify the PLL chip wiring, first isolate PLL IC pin 7 from the original wiring. Connect PLL IC pin 7 to PLL IC pin 8. Run a wire from PLL IC pin 1 to jumper J4. The other connections to the board are shown on the schematics. The three boards are made from .1"-spacing perfboard.

To make the diode matrix, on one side of the perfboard string 7 bare wires 4.5 inches (11.3 cm) across on one side. On the other side, string 20 bare wires perpendicular to those on the other side. Be sure to skip a row of holes between each string of wires. Then the diodes can be placed with one lead bent over in through the holes and soldered.

The FM detector can be mounted to the square hole above the BA521 IC with a small angle bracket. The modulator perfboard can be glued against the side of vco coil L1, being sure that nothing interferes with the tuning of the coil. The frequency board can be mounted across the front of the CB board, standing up vertically.

Tuning

For tuning, you will need a dc voltmeter, an rf probe, a signal generator (or a weak signal from an amateur transceiver), a frequency counter, and a General Cement model 9440 tuning tool.[3] A small hex head plastic tuning tool is also handy. Nothing ruins a powdered iron slug faster than trying to tune up with a regular screwdriver.

First, set the transceiver on 29.60 MHz simplex. Place a dc voltmeter on pin 6 of the PLL-02. Carefully tune vco coil L1 until 5 volts or so is reached. Move the voltmeter to pin 5 of the PLL-02. Carefully adjust vco coil L1 for 2.5 volts.

Next, attach a dummy load to the antenna jack. Place the rf probe on the base of Q3 (rf predriver). Adjust T1, L2, T2, L5, and T3 for maximum rf. Then move the rf probe to the antenna jack and adjust L7, L11, and L12 for maximum. Place the frequency counter on the antenna jack, and the counter should read 29.600 MHz. If the reading is a few kHz off, adjust trimmer CT1. If the reading is unstable, check the vco tuning. Run through all channels and see how each frequency looks. If an error shows, check the matrix and associated wiring.

Now, on receive, place the dc voltmeter on board pin 39 and adjust T5, T6, L14, T7, T8, T9, and T10 for maximum. Be careful not to overload. Adjust the quadrature coil on the FM detector/squelch board, with no signal, for maximum noise. Later tune when listening to another FM signal for best sound.

As a building hint, the housing for this radio can be built from aluminum. The box size is 6" (15.24 cm) by 8.5" (21.6 cm) by 2.5" (6.25 cm). Two U-shaped pieces of metal make up the top and bottom covers which fit over the ring of metal which makes up the main chassis.

That's it. Just look at the way I constructed it. As they say in the old country, "Ein Bild sagt tausend Worte."[4] I would like to thank Bob Russo WB2BMM for taking the photos shown here. If I can be of further help, please write, include an SASE, and I will try to help. ■

References

1. Knickerbocker K1DCS, Weise N1XN, Stielau W1WRO/N2XN, "CB on 10 FM – best conversion yet?", *73 Magazine*, January, 1980, p. 117.
2. Surplus Electronics Corp., 7294 NW 54 St., Miami FL 33166.
3. General Cement Electronics, Rockford IL 61101, or from your electronics parts distributor.
4. "A picture is worth a thousand words."

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HELP! Cleaning garage—test eqpt., 6m and 2m FM gear, tubes, 1000s of service manuals for all makes and models of commercial FM xceivers 1975 and older. Reasonable prices. Send SASE for list. Tom McLaughlin WB4NEX, PO Box 411, Mango FL 33550; (813)-681-9709. BNB051

WANTED—your unused Teletype™ repair parts. High prices paid! Send SASE for list of Teletypewriter parts and supplies. TYPETRONICS, Box 8873, Fort Lauderdale FL 33310; (305)-583-1340 after 9:00 pm. N4TT. BNB052

WANTED: Old bugs for my telegraph and radiotelegraph key collection. I am trying to find each make and model of bug manufactured before 1950. Vibroplex, Martin, McElroy, Bunnell, Mecograph, MacDonald, D & K, Warner, etc. Also looking for Spark keys, Boston keys, cooties, sideswipers, and large or unusual radiotelegraph keys. 73 de Neal McEwen K5RW, 1128 Midway, Richardson TX 75081; 1-(214)-234-1653. BNB053

ON MARCH 11, 1984, the Morgan County Repeater Association Club will sponsor the Martinsville Hamfest at the Indiana Fairgrounds Pavilion Building in Indianapolis. Dealers, vendors, forums, and free paved parking. Doors open to the public at 8:00 am. Table reservations: Aileen Scales, 3142 Market Place, Bloomington IN 47401. BNB039

WYOMING-UTAH RANCH LAND. 10 acres, $60 down, $60/month. FREE information, maps, photographs. Trade equity for ham gear, home computer, test equipment, etc. Owner—Mike Gauthier K6ICS, 9550-B—Gallatin Rd., Downey CA 90240. BNB001

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RTTY FDM DEMODULATORS. FDM RTTY exists on satellites, FM SCA broadcast subcarriers (e.g., Commodity News Service), and HF radio. Four solid-state synthesized models, NSA surplus, new-used, $50 to $350. Call/write for brochure. Electrovalue Industrial, Inc., Box 376-WF, Morris Plains NJ 07950; (201)-267-1117. BNB032

SPECIAL NOTICE—Buy and sell your amateur equipment, computers, and video equipment on our national computer system that you access from your home, etc. Ads are updated daily. Low cost is only $15.00 per year for unlimited access 24 hours a day. For details, send SASE. NARWID ELECTRONICS, 61 Bellot Road, Ringwood NJ 07456. BNB037

TRS-80 1/3/4 RTTY/ASCII/MORSE. Free specs. Software and hardware schematic, $24.95 postpaid. KCQ Software, 6319 Boeuf Trace, Alexandria LA 71301. BNB038

ON MARCH 11, 1984, the Morgan County Repeater Association Club will sponsor the Martinsville Hamfest at the Indiana Fairgrounds Pavilion Building in Indianapolis. Dealers, vendors, forums, and free paved parking. Doors open to the public at 8:00 am. Table reservations: Aileen Scales, 3142 Market Place, Bloomington IN 47401. BNB040

FOR SALE OR TRADE: Swan 100MX 5-band solid-state transceiver and ac PS and Heathkit SB-201 amplifier, $325 each. Wanted: CW transceiver. W7LHO, (505)-471-6377. BNB041

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MILITARY TECHNICAL MANUALS for old and obsolete equipment. 60-page catalog, $3.00. Military Technical Manual Service, 2266 Senasac Ave., Long Beach CA 90815. BNB045

RUBBER STAMPS: Name, call, and address. $3.75 postpaid, US. Floyd Durand W5YZC, PO Box 67, Westwego LA 70094. BNB046

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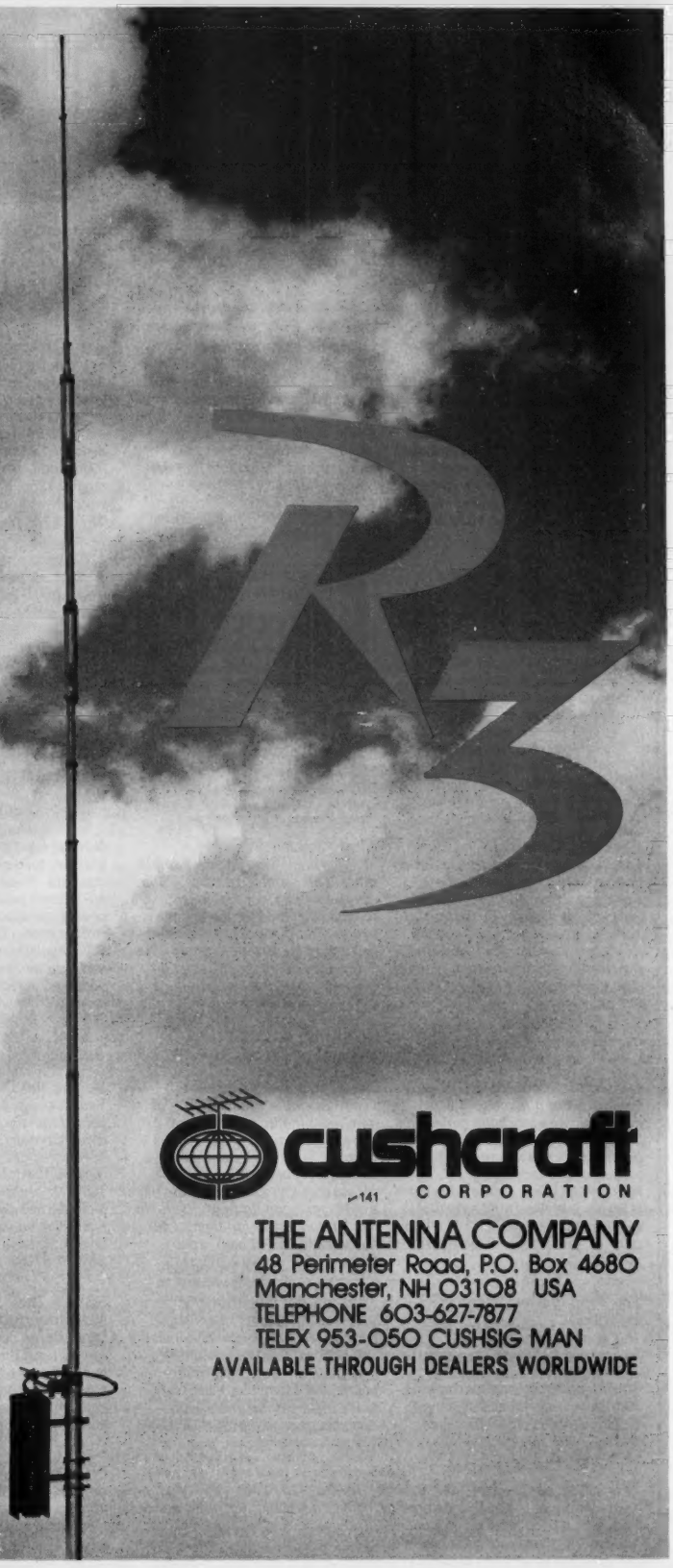

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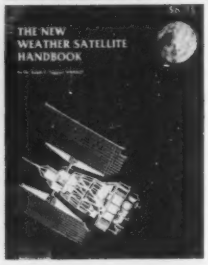

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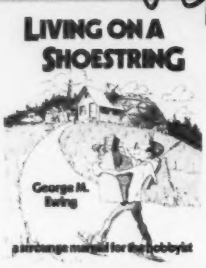

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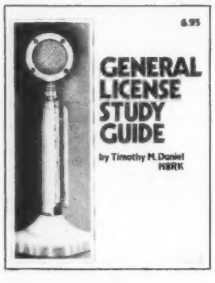

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SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine St., Peterborough NH 03458.

TRAVERSE CITY MI
FEB 11

The Cherryland Amateur Radio Club will hold its 10th annual swap and shop on February 11, 1984, from 8:00 am to 1:00 pm, at the Immaculate Conception School Gym, 2 blocks south and 1 block west of the intersection of M-37 and M-22, Traverse City MI. Registration will be at the door. Talk-in on 146.25/.85. For more information, call Jerry Cermak K8YVU at (616)-947-4848.

MANSFIELD OH
FEB 12

The Mansfield Midwinter Hamfest/Auction will be held on Sunday, February 12, 1984, beginning at 8:00 am, at the Richland County Fairgrounds, Mansfield OH. Tickets are $2.00 in advance and $3.00 at the door. Tables are $5.00 in advance and $6.00 at the door. Half tables are available. Talk-in on 146.34/.94. For additional information or advance tickets and tables, send an SASE to Dean Wrasse KB8MG, 1094 Beal Road, Mansfield OH 44905, or phone (419)-589-2415.

MELVILLE NY
FEB 19

The Long Island Mobile Amateur Radio Club will hold the LIMARC Indoor Hamfair '84 on February 19, 1984, from 0900 to 1600, at the Electrician's Hall, 41 Pinelawn Road, Melville NY. Admission is $3.00 each for everyone. Table reservations are $10.00 each, payable in advance to Bob Reed WB2DIN, 2970 Valentine Place, Wantagh NY 11793. Food and refreshments will be available. Talk-in on 146.25/146.85 (W2VL/R) or 146.52 simplex. For additional information, contact Al Fiapan WA2FBQ at (516)-796-2965 or Hank Wener WB2ALW at (516)-484-4322.

LANCASTER PA
FEB 19

SERCOM, Inc., and the Red Rose Repeater Association will sponsor the 1984 Lancaster Hamfest on Sunday, February 19, 1984, from 0800 to 1600, at the Guernsey Sales Pavilion, US Routes 30 and 896, Lancaster PA. General admission is $3.00 for all hams and dealer personnel; tailgating is free with general admission, weather permitting. Commercial tables (main hall) are $15.00 and noncommercial tables (rear annex) are $6.00. Talk-in on 146.61 and 147.015. For reservations, send a check payable to SERCOM, Inc., to Hamfest Committee, PO Box 6082, Lancaster PA 17603.

ELKIN NC
FEB 19

The seventh annual Elkin Winter Hamfest will be held on Sunday, February 19, 1984, at the Elkin National Guard Armory, located two miles off Interstate 77 at Exit 85 in Elkin NC. Doors will open to the public at 0830, and breakfast and lunch will be served at the hamfest by the Foothills ARC of Wilkesboro NC and the Briarpatch ARC of Galax VA. Talk-in on 144.77/145.37, 146.22/.82, and 147.69/.09. For table reservations (which are limited) or other information, contact either George Reeves WD4BMG, Route 6, Box 412, North Wilkesboro NC 28659, (919)-670-2803, or Tommy Lineberry WD4BTF, 308 Poplar Street, Galax VA 24333, (703)-236-8424.

GLASGOW KY
FEB 25

The annual Glasgow Swapfest will be held on Saturday, February 25, 1984, beginning at 8:00 am Central time, at the Glasgow Flea Market Building, 2 miles south of Glasgow, just off highway 31E. Admission is $2.00 per person. There is no additional charge for exhibitors. The first table per exhibitor will be free, and extra tables will be available for $3.00 each. There will be a large heated building, free parking, free coffee, and a large flea market. Talk-in on 146.34/.94 or 147.63/.03. For further information, write Bernie Schwitzgebel WA4JZO, 121 Adairland Court, Glasgow KY 42141.

FRIDLEY MN
FEB 25

The Robbinsdale Amateur Radio Club will hold its 3rd annual Midwinter Madness Hobby Electronics Show on Saturday, February 25, 1984, from 9:00 am to 3:00 pm, at Totino-Grace High School, 1350 Gardena Avenue NE, Fridley MN (a Minneapolis suburb). Admission is $3.00 in advance and $4.00 at the door. There will be manufacturers and dealers of ham, computer, satellite, and R/C gear, as well as seminars and a flea market. Talk-in on 146.52 simplex or the 147.60/.00 repeater (K9LTC). For more information, contact Robbinsdale ARC, PO Box 22613, Robbinsdale MN 55422, or call Bob at (612)-533-7354.

AKRON OH
FEB 26

The Cuyahoga Falls ARC will hold its 30th annual electronic equipment auction and hamfest on Sunday, February 26, 1984, from 8:00 am to 4:00 pm, at North High School, Akron OH. There is easy access from the Tallmadge Avenue off-ramp of North Expressway (Rte. 8). Tickets are $2.50 in advance and $3.00 at the door. Some tables are available for $2.00 or sellers may bring their own; advance reservations are advised. Talk-in on .87/.27. For more details or reservations (please include an SASE), write CFARC, PO Box 6, Cuyahoga Falls OH 44222. Table reservations may also be made by calling Bill Sovinsky K8JSL at (216)-923-3830 and will be held until 9:00 am.

EGG HARBOR CITY NJ
MAR 10

The Shore Points Amateur Radio Club, Inc., will hold the Springfest '84 on Saturday, March 10, 1984, from 9:00 am to 4:00 pm, at the Atlantic County 4-H Center, Egg Harbor City NJ (approximately 15 miles west of Atlantic City). Admission for buyers is $2.50 in advance and $3.00 at the door; sellers' space is $5.00 (bring your own table). There will be 8,000 square feet of heated indoor selling space, and covered tailgating will be available, weather permitting. For more information, write SPARC, PO Box 142, Absecon NJ 08201.

INDIANAPOLIS IN
MAR 11

The Morgan County Repeater Association Club will hold the Martinsville Hamfest on March 11, 1984, indoors at the Indiana State Fairgrounds Pavilion Building, Indianapolis IN. Admission is $4.00 at the door. Premium tables are $30.00 each, flea-market tables are $8.00 each, and flea-market space without a table is $1.00. All tables must be reserved in advance and setup will be Saturday, March 10, from 1:00 pm to 9:00 pm. Space setup will be Sunday, March 11, from 6:00 am to 8:00 am. There will be free paved parking. Talk-in on 147.21 and 146.52 simplex. For more information or table reservations, send an SASE to Aileen Scales KC9YA, 3142 Market Place, Bloomington IN 47401 before March 1.

WINCHESTER IN
MAR 11

The Randolph Amateur Radio Association will hold its 5th hamfest on Sunday, March 11, 1984, from 8:00 am to 5:00 pm, in the National Guard Armory, Winchester IN. Ticket donation is $3.00 and children under 12 years old will be admitted free. Table space (by reservation only) is $5.00 with a table and $2.50 without. There will be a flea market, dealers, programs, food, and drink. Setups will be on Saturday from 6:00 pm to 8:00 pm and on Sunday from 6:00 am to 8:00 am. Talk-in on 147.90/.30, 224.90/223.30, and 146.50. For reservations and more information, contact RARA, Box 203, Winchester IN 47394, or phone Jake Life W9VJX at (317)-584-9361.

MIDLAND TX
MAR 17-18

The Midland Amateur Radio Club will hold its annual St. Patrick's Swapfest on Saturday and Sunday, March 17-18, 1984, at the Midland County Exhibit Building, east of Midland TX on the north side of Highway 80. The hours on Saturday are from 10:00 am to 6:00 pm and on Sunday from 8:00 am to 2:30 pm. Registration is $5.00 in advance and $6.00 at the door; tables are $6.00 each. Refreshments will be available. Talk-in on .16/.76 and .33/.93. For further information and reservations, please contact Midland Amateur Radio Club, PO Box 4401, Midland TX 79704.

DAYTON OH
APR 27-29

The 1984 Dayton Hamvention's International VHF/UHF Conference will be held concurrently with the Hamvention from Friday through Sunday, April 27-29, 1984, at the Hara Arena and Exhibition Center, Dayton OH. There will be technical forums by acknowledged experts; noise-figure, dynamic-range, and antenna-range measurement contests; and a hospitality suite with refreshments. Technical papers and presentations on VHF/UHF topics of interest are being solicited for consideration. Potential speakers should submit their requests immediately. For further information, contact Jim Stitt WA8ONQ, VHF/UHF Conference Moderator, 4126 Crest Manor, Hamilton OH 45011.

DAYTON OH
APR 27-29

The Dayton Amateur Radio Association, Inc., will sponsor the Dayton Hamvention on April 27-29, 1984, at the Hara Arena and Exhibition Center, Dayton OH. Admission, valid for all three days, is $7.50 in advance and $10.00 at the door. The Saturday evening Grand Banquet and Entertainment is $14.00 in advance and $16.00 at the door. Harry Dannals W2HD, past president of the ARRL, will be the featured speaker. Because seating is limited, early reservations are requested. There will be a giant flea market starting at noon on Friday and continuing all day Saturday and Sunday. Flea-market space is $15.00 for all three days and will be sold in advance only. Entrance for setups will be available starting Wednesday and the special flea-market telephone is (513)-223-0923. Other features will include forums, awards, and exhibits. For special motel rates and reservations, write Hamvention Housing, Box 1288, Dayton OH 45402; no telephone reservations will be accepted. Address all other inquiries to Box 44, Dayton OH 45401, or phone (513)-433-7720. Please send advance registration checks to Dayton Hamvention, Box 2205, Dayton OH 45401.

FCC

Reprinted from the Federal Register

Changes in Procedures for Approval of Proposed Antenna Structures in the Amateur Radio Service; Announcement of Effective Date and Correction

AGENCY: Federal Communications Commission.

ACTION: Final Rule; announcement of effective date and correction.

SUMMARY: The effective date of rules amending this document sets Parts 17 and 97 to change procedures for approval of proposed antenna structures in the Amateur Radio Service (2-5-81; 46 FR 10915). The rule amendments were adopted by the Commission on January 8, 1981, but their effective date has been held in abeyance pending clearance of reporting requirements by the General Accounting Office. The amendments are necessary to permit amateur radio operators to file a single form to obtain approval of proposed antenna structures, instead of the two forms (610 and 714) currently required. The effect of this action is a simplification of the antenna approval process for both amateur radio licensees and the Commission.

The antenna approval form number is 854.

DATE: The effective date of the rules changes is January 3, 1984.

In § 17.4(h), where there is a blank space following the word Form, insert the number 854. In § 97.45(a). where there is a blank space following the word Form, insert the number 854.

AWARDS

Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

DX AWARDS FROM SWEDEN

The Bull Award

In order to make the province of Dalsland, Sweden, better known and to increase the activity of the amateurs in that region, the Melleruds Radio Club (SK6CM) decided to issue the Bull Award.

To qualify for this diploma, stations in Norway, Sweden, Finland, and Denmark must achieve 10 points, other European stations must achieve 5 points, and stations outside Europe must obtain 2 points credit. Every QSO with a radio amateur residing in Dalsland will give the applicant 1 point toward his or her goal. Should you have a QSO with SK6CM, 2 points will be credited to your total. All bands and modes will be allowed, but only one QSO with each station will count. All QSOs must be on or after January 1, 1979. Contacts via a repeater or satellite will not count.

Applications must list each callsign worked, date, time, GMT, band, mode, and the applicant's own name, call, and full mailing address. QSLs are not required. General certification rules apply. The award fee is 5 US dollars or 20 Swedish kroner. Send your application and award fee to Melleruds Radio Club, 464-00 Mellerud, Sweden.

As of April 25, 1979, the following amateurs would qualify for contacts to obtain this award: SK6CM, SM6s: AGW, ALJ, AMU, ASJ, AWZ, BER, BGG, BLE, BOT, BPX, CGI, CJK, CLX, CMK, CNC, COY, COZ, CQK, CUA, CWK, CYU, DKU, DXY, EOI, EPA, ESW, EUC, EUT, FCM, FFK, FLR, FNE, GAS, GDP, GMR, GQJ, HQZ, HRL, IHF, JJZ, JKB, JMA, JOD, JOG, JOM, JOO, JQA, JRB, JRY, JUJ, KFA, KFB, KFF, and ST.

The SWL Activity Club of Sweden and their award manager were very kind to send me complete award program information about the two major DX awards being offered by their organization.

Worked All Zone-14 Countries Award

This award is available to amateurs in three levels of achievement: Class A—work 27 countries in CQ Zone 14, Class B—work 22 countries in CQ Zone 14, and Class C—work 15 countries in CQ Zone 14.

There are no band or mode limitations, nor are there any date restrictions known at this time. Applications for WAZ14CA are sent with US$2.00 or 10 IRCs to SWL Club Activity, Fack 55, S-780, 40 Mockfjard, Sweden. GCR apply.

Countries in CQ Zone 14 are: CT1, CT2, C31, DA/DF/DJ/DK/DL, DM, EA, EA6, EI, F, G, GD, GI, GJ, GM, GU, GW, HB9, HB0, LA, LX, ON, OY, OZ, PA/PI, SL/SK/SM, ZB2, 3A, 4U (Geneva).

Worked ITU Zones 17/18 Award

This award is available to amateurs in three levels of operation: Class A—work all countries in ITU Zones 17/18, Class B—work 7 countries in ITU Zones 17/18, including TF (Iceland), and Class C—work 5 countries in ITU Zones 17/18.

Endorsements will be made available for single-band or -mode achievements. Applications must be sent to the SWL Club Activity with 10 IRCs or US$2.00. Mailing address is Fack 55, S-780, 40 Mockfjard, Sweden.

Countries located in ITU Zones 17/18 are: ITU Zone 17—TF; ITU Zone 18—JW, JX, LA, OH, OH0, OJ0/OH0M, OY, OZ, ZM.

Morokulien Award

Our good DX friend, Erland Belrup SM7COS, enlightened us with news about the charitable Morokulien (SJ9WL/LG5LG) activity in the unique "state" on the Norwegian-Swedish border, east of Oslo, featuring radio calls LG5LG and SJ9WL and a lot more.

Recognizing the independency of this area, the Morokulien activities have been stimulated to benefit the handicapped radio amateurs in Norway and Sweden. Likewise, applicants for the Morokulien Award find their donated award fees going to aid these less fortunate people. . . a cause all of us can be proud to have assisted.

This unique DX award is available to licensed amateurs and SWLs. Only contacts after July, 1968, will count. Applicants are asked not to send QSL cards. GCR apply. Europeans must contact LG5LG and SJ9WL on two bands and on different days for a total of four days of operation.

All other applicants must work each of these two stations, each on a different day.

You may forward your application to the attention of Ulf Strandberg LA2ZN, Kongiev. 3, N-2200 Kongsvinger, Norway. Please be sure to enclose an award fee of US$3.00 or 8 IRCs. Additional contributions are most appreciated.

DX AWARD FROM ROMANIA

The Romanian Radio Amateur Federation takes pleasure in announcing the YO DX Club Award available to amateurs and SWL stations the world over.

YO DX Club Award

To qualify for the YODXC Award, applicants in Europe need to confirm contact with five YO DX Club members; stations outside Europe need confirm only two YO DX Club membership contacts. All QSOs must be made after August 23, 1949, and may be made on any mode or combination of modes and any band in the HF, VHF, or UHF segments.

To apply, have your list verified by at least two amateurs and send your list with US$1.00 or 7 IRCs to: FRR (YODXC), PO Box 1395, R 76100 Bucuresti 5, Romania.

As of January 1, 1978, the following YO DX Club members count towards this award:

YO2s: ABW, AVP, BA, BB, BN, BS, BU, BV, CD, FP, GL, GZ, IS, KAB, KAC, KAR, QY, RA, VB, VF.

YO3s: AAJ, AAQ, AC, AVE, BAA, CR, DZ, FF, FU, JF, JU, JW, KAA, KBC, KSD, NN, QK, QO, RD, RF, RG, RK, RO, RX, VN, YZ.

YO4s: ASG, CS, CT, HW, KAK, KBJ, KCA, WO, WU, XF.

YO5s: AFJ, AMO, ATV, AUG, AVN, AY, BW, DS, KAD, KAU, KLA, LC, LD, LP, NB, NU, NZ, UW.

YO6s: ADM, AW, EX, KAF, KAL, KBA, KBM, LG, UX, XI.

YO7s: BI, DL, DO, KAJ, NA, NM, VS.

YO8s: AGZ, CF, DD, FZ, GF, KAE, KAN, KGA, ME, MH, OK, OP, RL.

YO9s: APJ, ASS, BGV, CN, EM, GP, HH, HI, HT, IA, IF, KAG, KPD, VI, WL.

YO0s: ITU, YROA.

In YO-land, the suffix for the same licensed ham is the same for any prefix.

DX AWARDS FROM THE RADIO CLUB OF PARAGUAYO

The All Mediterranean Countries Award

The AMCA is given for confirmed contacts with Mediterranean countries in three levels of achievement: Class A—41 countries, Class B—30 countries, and Class C—20 countries. A ZP contact is obligatory in any class of award. The following prefixes qualify as valid contacts: A2, A5, AC3, C31, CP, HA, HB, HB0, HV, JT, LX, OE, OK, TL, TT, TZ, UC2, UD6, UG6, UH8, UI8, UL7, UM8, UO5, XT, XW8, YA, ZE, ZP, 3D6, 4U1, 5U7, 5X5, 7P8, 7Q7, M1(9A), 9J2, 9N1, 9U, 9X.

All Zone 11 Prefix Award

The AZ11PX Award is given for confirmed contacts with prefixes in CQ Zone 11 as follows: Class A—30 prefixes, Class B—19 prefixes, and Class C—12 prefixes.

ZP1 to ZP9, PY1 to PY0, and the special prefixes used for WPX contests are the only prefixes which qualify for this very difficult award.

The Tropics of Cancer and Capricorn Award

The TCCA Award is afforded to those applicants who confirm contacts with countries touched by the Tropics of Cancer and Capricorn boundaries. A ZP contact is obligatory for this award. For Class A, 28 country contacts are required from the list below. Class B requires 20 countries; Class C requires 12 countries. The following prefixes qualify as valid contacts:

Tropic of Cancer: S2/3, BV, BY, EA9, KH6, A4, A6, SU, TZ, C6, VU, XE, XZ, 5A, 5T5, 5U7, 7X, 7Z.

Tropic of Capricorn: A2, CE, C9, LY, PY, VK, ZP, ZS, ZS3, 5R8.

The Diploma Sud-America

The DSA Award is given for contacts with countries located in ITU Zones 12, 13, 14, 15, 16, and 73 as follows: Class A—33 DX countries and 6 ITU zones, Class B—25 DX countries and 6 ITU zones, and Class C—18 DX countries and 5 ITU zones.

Countries which are qualifying contacts are:

Zone 12—FY, HC, HC8, HK, HK0 (Malpelo), OA, PZ, 8R, YV, CP1/8/9.

Zone 13—PY6/7/8, PY0 (Fernando de Noronha), PY0 (St. Peter, St. Paul).

Zone 14—CE1/2/3/4/5, CE0X, CE0Z, CP2/3/4/5/6/7, ZP, CX, LU-A/U/Y.

Zone 15—PY1/2/3/4/5/9, PY0 (Trinidad Island).

Zone 16—CE6/7/8, VP8 (Falkland), LU-V/W/X.

Zone 73—KC4USP, LU-Z, CE9AA/AM, VP8 (Graham Land), VP8 (Georgia), VP8 (So. Orkney), VP8 (So. Sandwich), VP8 (So. Shetland).

Diploma Paraguay

The DP Award is given for confirmed contacts with five different ZP stations. Stations in South America are required to contact 15 ZP operators.

Worked All ZP

The WAZP Award is being offered to amateurs making at least one confirmed contact with ZP stations in each of the ZP call districts, ZP1-ZP9.

Diploma Departmentos Del Paraguay

The DDP is given for confirmed contacts with the nation's capital and different departments into which Paraguay is divided. Class A requires 20 contacts; Class B requires 16 contacts; Class C requires 12 contacts.

Departments by prefix are: ZP1—Boqueron, Chaco, Nueva, Asuncion; ZP2—Altos, Pte. Hayes; ZP3—Amambay, Concepcion; ZP4—Canendiyu, San Pedro; ZP5—Asuncion (nation's capital); ZP6—Central, Cordillera, Paraguari; ZP7—Caaguazu, Caazapa, Guaira; ZP8—Misiones, Neembucu; ZP9—Alto Parana, Itapua.

Contacts must be made on or after May 15, 1952, to qualify for any of the awards sponsored by the Radio Club of Paraguay. A certified list of contacts with a fee of 5 IRCs for each award should be sent to: Elio Donna ZP5CE, Award Manager, RC Paraguayo, PL Box 512, Asuncion, Paraguay.

3905 CENTURY CLUB AWARDS

Representing the 3905 Century Club, Bill Herbert WA2ZYM writes to share with us the various awards available to amateurs who frequent their net operation.

The 3905 Century Club is basically a WAS (Worked All States) net which grew out of the old Bicentennial Net on 80 meters back in 1976. The net now operates daily on 40 and 80 meters, 0100-0500Z on 7.233 MHz and 0500-0800Z on 3.905.

Naturally, as time went on, it became apparent that an awards program of some kind was in the offing. As amateurs work each other on the band, they gather a point per contact. Once 100 points are earned, you become a full-fledged member of the club and are issued a certificate to illustrate your affiliation.

As members continue their contacts on the net, several levels of achievement are recognized, with the ultimate being the 1,000-Point Award, which is certainly no overnight venture.

Among the certificates afforded net participants is the 3905 Century Club State Capitals Awards, which requires the applicant to contact at least 35 state capital cities. Endorsements are given for 40, 45, and the maximum of 50 state capitals worked on the sponsor net.

HAROAA AWARDS

We believe the many long hours of dedicated operation should not go unnoticed, nor should the high degree of enthusiasm of amateur-radio operators go neglected in their pursuit of self-set goals. That is why we have an awards column in this magazine and why I introduce to you the awards and certificates made available by HAROAA.

As we review each one individually, we find that all their awards are of high quality and will make a very impressive addition to any radio shack.

GCR apply in making application for HAROAA Awards. Each award is two dollars or 5 IRCs. At your request, special endorsements will be added for CW, SSB, RTTY, SSTV, FM, QRP, All YL, or single band. There is no date restriction on contacts made and satellite contacts are permitted.

HAROAA DX Award

For this, the most popular of all HAROAA achievement awards, the applicant is awarded recognition for contacting 10 DX stations. Endorsements are also given for 25, 50, 75, 100, 200, and 500 DX

contacts. Keep in mind we are not speaking of DX countries, but instead, DX "contacts," which makes this award unique.

Great Lakes Award

This award requires one contact from each state bordering the Great Lakes: New York, Pennsylvania, Ohio, Michigan, Indiana, Illinois, Wisconsin, and Minnesota.

Insomnia Award

This award is earned for communicating with a single amateur station anywhere in the world for a minimum of one hour between the hours of 1:00 and 5:00 am. Truly a super conversation piece for any ham shack.

Super Certificate Hunters Award

This award is designed for the serious certificate hunter. To earn this award, you must have a minimum of ten amateur-radio awards in your possession. Simply list these awards on your application and note the certificate number of each. Special endorsements are given for your collection of 25, 50, 75, 100, and 100 plus.

Official Traffic Handler Award

This award is a self-issued achievement, allowing you to display the fact that you are indeed an official handler of radio traffic.

HAROAA Super Operator Award

This certificate is rendered for those providing a service on behalf of amateur radio, such as weather observer, public service, emergency, helping a new ham, providing communications for a community function, etc. The requirements are for the applicant to briefly describe the event of service. The officials at HAROAA will determine whether it deserves this special recognition.

For your personal copy of HAROAA award program rules or to apply for any awards presented here, write: HAROAA Award Program, PO Box 341, Hinckley OH 44233.

NORAC WINTER CARNIVAL

The North Okanagan Radio Amateur Club will have a special station set up during its Winter Carnival (western Canada's largest). This is a free award but we would sure appreciate $1.00 or 2 IRCs to cover the postage. The award is available to all amateurs worldwide who contact 3 Vernon area stations or QSO once with our club station VE7NOR; any mode or band is permissible. Our special station will be operating daily from February 1 until February 12, 1984. Times will be from 2100Z to 2430Z. Look for us in the General portion of each band, about 50 kHz up, calling "CQ Winter Carnival Award."

SCHOLARSHIP HONORS SENATOR GOLDWATER

In Washington DC on November 9, Senator Barry Goldwater (R-Arizona) announced to his fellow ham-radio operators around the world that the American Radio Relay League had established an annual $5,000 scholarship award in his honor.

The League will award the scholarship to a licensed radio amateur enrolled in college-level study of electronics, communications engineering, or a related field. The program will be administered by the ARRL Foundation, Inc., the League's tax-exempt research and educational organization.

Goldwater, known to thousands of radio amateurs as K7UGA, made the announcement from his "ham shack" on Capitol Hill. Within seconds after the ceremonial transmission, Goldwater began receiving congratulatory messages from ham operators throughout the US and several foreign countries.

The late Vic Clark, League president, explained that Goldwater was selected as honoree for the organization's new scholarship because his "selflessness and dedication to purpose as a government servant is widely recognized and deeply appreciated by both his fellow citizens and the radio amateurs of our country."

"Through his amateur-radio involvement, Senator Goldwater has brought joy to thousands of members of our armed services," Clark said, recalling that the Arizona senator opened his radio facilities for around-the-clock operations during the Vietnam War to provide a communications link between US military personnel in Southeast Asia and their families.

Goldwater, whose interest in amateur radio dates back to his teenage years, said the value of ham operators has been demonstrated repeatedly in times of local or national emergency.

The recent Grenada mission is a case in point. Practically no normal communications were available to the public. Ham-radio operators quickly opened links with the Caribbean island, particularly handling messages relating to the safety of several hundred American students at St. George's College. It was through these amateur channels that the press and public received most of their information during the early days of the mission.

For a brief while, Americans were once again reminded of the important role played by radio amateurs. More often, though, the crucial contribution made by ham-radio operators has become "so commonplace that it often goes unnoticed and uncredited," Goldwater said.

Information about the scholarship program can be obtained from the ARRL Foundation, 225 Main St., Newington CT 06111.

HAM HELP

I need schematics and manuals for the Hallicrafters S77 communications receiver, Heathkit HR-10 receiver, and Johnson Viking II transmitter. Thank you.

Shawn Jerin
4-710 West Leila Ave.
Tampa FL 33616

I wonder if anyone has a parts catalog so that us old-timers can find radio and ham gear such as transformers, coils, chokes, and hard-to-find tubes.

Clarence L. Frady
1207-A Old 70 West
Black Mountain NC 28711

Has anyone had any trouble building the "Down-Under Depth Sounder" (July, 1983)? Mine won't work.

C. G. Wortham N9AKD
28 W. 559 Rogers Ave.
Warrenville IL 60555

Needed: schematic for a DSI counter, Model 5600A. Happy to pay reproduction costs.

John E. Greve
4211 7th Ave.
Rock Island IL 61201

CORRECTIONS

Two errors crept into recent issues. In November (page 103), we inadvertently listed DA1TN as the third-place DX multi-op finisher in the 1983 40m World SSB Championship. The correct callsign is DA1US.

Also, in "Idiot Buzzer for the 1978 Honda Civic" ("Circuits," December, page 99), the bottom three diodes are reversed.

Jack Burnett
Executive Editor

THE ONE STOP SOURCE SINCE 1959!!

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MICRO 8/U (95% BRAID-FOAM)115/M'
RG-213/U (96% BRAID-POLY)270/M'
RG-214/U (2-96% BRAIDS-POLY)495/M'

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8/C HAMLINE (2-18/6-22)$150/M'
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12

SLEP SPECIALS

ROCKWELL/COLLINS

KWM-380 transceiver 9 band plus general coverage receiver. 5-30 MHz with WARC/MARS coverage, latest model with s/n above 2,200. All production bulletins thru #18, built-in AC/DC power supply ..... LIST $6,600.00, SALE $5,475.00

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AC-3801 noise blanker	LIST $ 360.00,	SALE $ 320.00
AC-3802 speech processor	LIST $ 396.00,	SALE $ 350.00
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AC-3805A Keypad, ready to plug in control interface, as seen in Collins ads,	LIST $ 175.00,	SALE $ 135.00
AC-3810 CW filter, 360Hz,	LIST $ 180.00,	SALE $ 160.00
AC-3811 CW filter, 140 Hz,	LIST $ 180.00,	SALE $ 160.00
AC-3812 RTTY filter, 1.7 KHz,	LIST $ 180.00,	SALE $ 160.00
AC-3821 emergency DC stand-by cable,	LIST $ 108.00,	SALE $ 96.00
MM-280 hand held microphone,	LIST $ 64.00,	SALE $ 56.00
SM-280 desk microphone,	LIST $ 144.00,	SALE $ 128.00
KWM-380 service manual		$ 40.00

HENRY LINEAR TUBE AMPLIFIERS

1KD5, 1200 W PEP desk type, 3-500Z	LIST $ 695.00,	SALE $ 625.00
2KD Classic, 2KW PEP, desk type, pair 3-500Z	LIST $1,080.00,	SALE $ 969.00
2K Classic, 2KW PEP, console type, pair 3-500Z	LIST $1,395.00,	SALE $1,249.00
AK Classic X, 2KW PEP, console type, pair 3-500Z,	LIST $1,695.00,	SALE $1,525.00
3K Classic, 2KW PEP, console type, 8877 tube	LIST $2,695.00,	SALE $2,450.00

GO VHF/UHF DX WITH A HENRY SSB/CW AMPLIFIER

1002A 146 MHz, 1 KW PEP input, rack mount, 8874 tube	$ 895.00
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2002A 146 MHz, 2 KW PEP input, console, 3CX 800A7 tube	$1,295.00
2002A-220 220 MHz, 2 KW PEP input, console, 3CX800A7 tube	$1,395.00
2004A 430 to 450 MHz, 2 KW PEP input, console, 3CX800A7 tube	$1,395.00

Shipping charges additional. We accept VISA/MC or TAKE ADDED BONUS OF 2% DISCOUNT off purchase price by carhiers check or money order.

For personal service, write or phone Bill Slep 704-524-7519.

Slep Electronics Company
P.O. BOX 100, HWY. 441
OTTO, NORTH CAROLINA 28763
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See List of Advertisers on page 98

NEW PRODUCTS

TC-1 PLUS ATV TRANSMITTER/ DOWNCONVERTER

P. C. Electronics has upgraded their TC-1 all-in-one-box 420–450-MHz full-color ATV unit with some new features. The new unit is called the TC-1 Plus. With more and more amateurs using computers and VCRs on ATV, separate video and audio inputs were added to the existing camera and mike inputs. This allows front-panel switching back and forth between the camera and computer, or transmitting the VCR audio along with voice-over commenting using a microphone. It has made learning Basic computer language over the air and retransmitting the Space Shuttle video and audio easy.

Capability for external 13.8 V dc has been added to the built-in ac supply for those who want to go mobile or portable on battery power during Field Day, emergency services, CAP searches, parades, marathons, or other public-service events.

A video monitor output is now provided to enable seeing your own picture exactly as it is transmitted in order to better set modulation levels, lighting, etc. This is accomplished by the built-in diode detector on the transmitter rf power output stripline which then connects to the composite video-monitor line-driver circuit.

The TC-1 Plus has the new TXA5-5 exciter/modulator which features two-frequency plug-in crystal switching with just the addition of an SPST switch. Also, the bulletin sync stretcher and hi/lo power switch capability enable superior stable color video if a higher-power linear amplifier, such as the Mirage 100-Watt D1010N, is added later or run barefoot at its greater than 10 Watt PEP rf output.

The 420–450-MHz tunable downconverter has the low noise NE64535 preamp stage to dig out the weak signals. It acts like a super hot UHF TV tuner but covers only the 70cm ham band when connected to your TV set antenna input and set for channel 3 or 4. Both color video and sound live action ATV are available on your TV set just as the broadcast stations provide. The standards are the same.

With the TC-1 Plus, the only other items necessary to get on ATV are a good 70cm antenna and low-loss coax, your TV set, and any device with a standard low-voltage p-p composite video output commonly found on black and white CCTV cameras, home video color cameras and VCRs, computers, RTTY/video converters, etc. A Technician class or higher amateur-radio license is required for operation and purchase from P. C. Electronics.

For more information and a complete catalog of ATV equipment, antennas, cameras, modules, and accessories, call or write *P. C. Electronics, 2522 Paxson Lane, Arcadia CA 91006; (818)-447-4565.*

SOFTWARE PROTECTION SYSTEM

Software Protection Devices, Inc., a division of Wayne Green Enterprises, has introduced Copyrighter, a hardware-based protection system using encryption technology. The Copyrighter system has been proven by beta testing to provide pirate-proof software protection.

Software to be protected by Copyrighter is first encoded using a Data Encryption Standard (DES) algorithm which scrambles the machine code of the program. The customer, on the first use of the protected program, calls an 800 number and obtains a code which will unlock the program. The user types in this enabling number to decode the DES encryption and prepare it for use with the Copyrighter CPU (C-CPU).

The C-CPU is a standard CPU with a different decoder built into each unit. It is installed by a dealer on owned equipment or at the factory on new computers.

One C-CPU can be used to decode any number of protected programs, yet it will run unprotected software with no interference. This system does not slow down the CPU, even on protected programs. A protected program may be freely backed-up by the user on any medium and will run only on the user's computer.

Copyrighter software protection boundaries are flexible to allow the publisher to leave certain portions of their software, such as I/O routines, unprotected and modifiable by the user. All unprotected portions may be written in any programming language.

For more information, contact *Ken Witham* at *Wayne Green Enterprises, Inc., 80 Pine St., Peterborough, NH 03458; (603)-924-9471.* Reader Service number 480.

The System 70X satellite receiver from Lowrance Electronics.

SATELLITE RECEIVER

Lowrance Electronics of Tulsa, Oklahoma, has introduced a new satellite receiver for 1984. The new receiver unit, called the System 70, follows the firm's system 7 and will be manufactured at the company's headquarters in Tulsa. The receiver will be marketed through a worldwide distributor network.

The System 70 receivers feature detent tuning, polarity control, a signal-strength meter, built-in modulator, scan tuning, and wide and narrow audio filters. The receivers are available as the standard model 70X or the stereo version, 70S, which decodes both matrix and discrete stereo sound and features simplified stereo tuning. Both models carry a full one-year warranty.

For additional information, contact *Lowrance Electronics, Inc., 12000 E. Skelly Drive, Tulsa OK 74128.* Reader Service number 479.

NEW TRIBAND BEAMS

Palomar Engineers has announced the availability of two triband beams. Model DX-33 has three elements on 10, 15, and 20 meters. Model DX-43 has four elements.

These antennas have long been used by European DXers and are being made available in the US for the first time.

Designed for use with solid-state transceivers, the antennas feature low swr and wide bandwidth. Gain and front-to-back ratio are particularly good. Each trap is individually sweep tested at the factory for uniform performance. Stainless-steel U-bolts are used throughout.

For more information, contact *Palomar Engineers, 1924-F West Mission Road, Escondido CA 92025; (619)-747-3343.*

NEW SOFTWARE FOR THE TRS-80

Woodall Software has announced a TRS-80 program for transmission and reception of RTTY that does not require a TV or interface for operation. The SOFTTY program will work as well or better than software/hardware packages requiring a PLL decoder. Only the much more expensive TUs may give consistently better results.

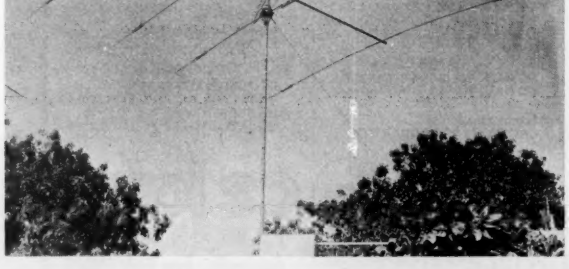
Gary Woodall has devised an algorithm for this program that samples the incoming audio signal to measure the tone frequency and shift using the cassette READ port. This method is very effective and makes the system immune to most noise. The only thing that may be a problem is other signals which are almost exactly on your operating frequency.

The program was written entirely in Z-80 machine language to obtain the processing speed necessary for the algorithm and associated functions. Timing is very critical and necessitated close attention to T states and M cycles during programming (down to micro-seconds).

The tone-generating section of SOFTTY simulates the two RTTY tones by producing an alternating time-controlled voltage and outputting via the cassette WRITE port. The output from the AUX plug is then fed into the microphone input circuit of the transmitter. Most mike input circuits will smooth the simulated sine-wave signal, making it sound like a true sine wave when transmitted.

SOFTTY Version 1.0 has split-screen

P. C. Electronics' ATV unit.



Triband beams from Palomar Engineers.

The IC-27A mobile unit from Icom.

The Icom IC-271H transceiver.

operation so that the main buffer may be filled while decoding and displaying the received signal. A choice of high and low toners is keyboard selectable, as well as normal and inverted (mark/space or space /mark) tone detection.

SOFTTY 1.0 is set for a 170-Hz tone shift used by amateur-radio operators. Other versions are available for different shifts used by news and weather services. A visual tuning indicator makes setup easy to accomplish.

There are five programmable buffers available, each of which can hold up to 255 characters. They can be filled from the keyboard and saved to magnetic tape for later retrieval.

For more information, contact *Bill Gouge* or *Gary Woodall* at *Woodall and Associates, PO Box 284, 11 Glenda Drive, Plainfield IN 46168; (317)-271-2565.* Reader Service number 481.

NEW FROM ICOM

Icom has introduced three new models of amateur equipment: the IC-27A two-meter 25-Watt mobile unit, the IC-04A and IC-04AT 440-MHz hand-held transceivers, and the IC-271H 100-Watt two-meter base-station transceiver.

IC-27A

The IC-27A is an important breakthrough in two-meter mobile communications. Measuring 1-1/2 inches high by 5-1/2 inches wide, the IC-27A contains an internal speaker making it easy to mount.

Although the IC-27A is compact, it has not sacrificed any features. Standard features include 25 Watts of output power, 32 PL™ frequencies, ten full-function tunable memories, scanning of memories and the band, priority scan, and a microphone which includes a 16-button touchtone™ pad for access to a repeater or dialing through to an autopatch. An optional speech synthesizer also is available to verbally announce the receiver frequency of the transceiver through the push of a button.

The IC-25A, measuring 2 inches wide by 5-1/2 inches high, will continue to be available for those individuals preferring a 25-Watt two-meter mobile unit with larger operating knobs.

IC-04A and IC-04AT

Icom has announced their latest in 440-MHz hand-held transceivers: the IC-04A and IC-04AT. These multi-function, multi-feature hand-helds for 440-449.995 MHz feature frequency entry, control functions, and 32 PL tones which are controlled by the 16-button pad on the face of the radio. Also included are priority scanning (both of memories and programmable band scan) and DTMF (04AT only).

For scanning, 5-kHz increments are front-panel selectable. Ten memories with internal lithium battery backup afford flexibility for channelizing operation for easy access to most-used channels. The custom LCD readout with S-meter is unique.

The IC-04A and IC-04AT have the same styling, control features, and functions as the IC-02A(T) and utilize the existing accessory line available for the IC-2A and IC-2AT plus new accessories such as long-life and high-power battery packs.

IC-271H

For two-meter communications, Icom also has developed the IC-271H, a transceiver with a high dynamic range receiver and a 100-Watt transmitter. Operating from the IC-PS30, IC-PS15, or the internal IC-PS35 (optional), the IC-271H integrates all the functions of the latest CPU-controlled radios.

Standard features include 100 Watts of power, 32 built-in subaudible tones, 32 full-function tunable memories, 10-Hz PLL locking, easy-to-read fluorescent display, scanning, and mode scan. It is 11-1/4 inches wide by 4-3/8 inches high.

To facilitate the operation of the IC-271H, Icom has incorporated a duplex touch switch, all-mode squelch, receive audio tone control, S-meter, center meter, seven-year lithium battery memory backup, 24-pin accessory connector, and microphone. Optional features include a switchable preamplifier, CTCSS encoder/decoder (encoder is standard), computer interface, and voice synthesizer.

For more information, contact *Icom America, Inc., 2112 116th Ave. N.E., Bellevue WA 98004; (206)-454-8155.*

The IC-04A 440-MHz hand-held from Icom.

LETTERS

LOG PROGRAM AVAILABLE

The response to my article "Foolproof Logging" on page 58 of the November, 1983, issue of *73* was overwhelming. I had noted in the article that if enough persons were interested, I would make the program available.

The program is now available for the TRS-80 Model III under TRSDOS 1.3 and for the IBM-PC under PC-DOS 1.1 or 2.0. The cost is $35.00 each including the diskette and user's manual. Postage is included in the cost. A version written in dBASE-II source code will be available by January 1, 1984, for several computers.

John E. Fall KL7GRF
Long Beach CA

NO SNOBS IN SANTA FE

In response to the letter from Mr. Fearon printed in the October issue, please be advised that the snobbery he felt in Albuquerque has not reached the higher elevations and arrived in Santa Fe. Being 60 miles apart, there is a world of difference in all attitudes and amateur radio especially.

The Northern New Mexico Amateur Radio Club in Sante Fe will be more than happy to assist Mr. Fearon in directing him to hams who have the time and energy to be an Elmer. When I made up my mind to go for a ticket, I started going to the Saturday morning breakfasts the club holds each week at The Pantry restaurant. There I met the most helpful and supportive crowd of guys and gals and before you knew it, I had my ticket.

The NNMARC holds regular classes both for the Novice and for upgrading to other classes. All are at no charge.

The hams who helped me on the way to a license were most eager to do so and extended every courtesy to the point of going out of their way several times, especially when it came time for the Novice exam and code test.

So, not all Southwest hams are snobs, and I hope Mr. Fearon has by now found that to be true.

Michael Langford KA5SAT
Santa Fe NM

ALBATROSS

The editorial in the October issue of *73* revealed some interesting things. I have found *73* to be a very enjoyable magazine. The editorial touched on one area I am in agreement with. *QST* and the League are getting to be a useless albatross to amateur radio. The magazine has fewer and fewer technical articles and more and more pages of contest results and pat-em-on-the-back data.

I am of the old school of home brew: If you want a transformer, wind it. I've even made my own tubes out of light bulbs. Now I run my computer on what the filament used to draw.

I am an amateur more interested in construction than in operating, so the "incentive" of the League left me cold. Similarly, there is a trend to buy everything from Japan, yet we developed the technology they copied or stole.

This country still has creative engineers, people who are amateurs. I call it poor-boy research, amateur because of low funds, not lack of skill. This country is becoming a high-technology and farm export country, though our government and corporations are too stupid to foster education or family farms.

I like *73*'s view of trying to stay ahead of the pack. The concept of developing a colledge (no, I didn't misspell college) can provide an "edge" to a student not fulfilled by some of our prestigious struc-

tured schools, provided it teaches creativity. Creativity is a rare commodity at best, yet it is the very thing that once made this country great.

Escalating the college via cable is a good limited short-term idea. But cable TV is dead, only still quivering because of greed and failure to make it duplex. The time will soon come when fiber optics will replace it, allowing duplex operation. There is your future.

In the meantime, the proliferation of satellite dishes (7-10') will fill the void of cable. Direct satellite broadcast (2' dishes) will bankrupt the cable companies.

The concept of interactive teaching is an area not touched. Suppose the main program (class) was on laser disk, supported and controlled by a magnetic diskette for your microcomputer. Q&A would be on the disk and your terminal CRT. Further support could be by packet transmitted to the satellite or local data line.

At present, I spend about $1000 (plus) four times a year to go to schools: $500 travel, $500-$800 class and lodging. Wouldn't it be more profitable if I could take an interactive class here for $750 a year total?

The University of Wisconsin at Madison and Milwaukee has superb extension programs. George Washington University, Georgia Tech, and UCLA have extension work in engineering. These people have skilled people come in from all over the country to teach a class, yet the school only organizes the class. I have made friends all over the country this way and gotten credits as a bonus.

Phil Jedlicka WD0EED
Norman OK

CALL FOR PAPERS

The American Radio Relay League will hold its Third Amateur Radio Computer Networking Conference on April 15, 1984, in Trenton, New Jersey. The conference will be in cooperation with the 9th Trenton Computer Festival (TCF84) being held April 14–15 at Trenton State College.

The deadline for camera-ready papers is March 1, 1984. All papers should be mailed to Paul L. Rinaldo W4RI, American Radio Relay League, 225 Main Street, Newington CT 06111. If you plan to present a paper, please request an author's guide and identify the title of your paper immediately. Proceedings will be sold at the conference and by mail from ARRL Headquarters.

Technical papers are invited on all aspects of amateur packet radio, AMTOR, computer-based message systems, digital speech, presentation-level graphics, and related amateur-radio digital communications via terrestrial, ionospheric, meteor-scatter, and satellite media including AMSAT-OSCAR 10 and PACSAT. Topics may include network and system architecture, proposed standards, hardware, software, protocols, modulation and encoding schemes, applications, and practical experience.

Paul Rinaldo W4RI
Newington CT

MARKETABLE EDUCATION

I enjoyed the editorial in the October issue of *73*. However, I would go a little bit further. I think that education is a big issue *now* and, if handled correctly, will bring huge profits for the first businesses to take full advantage of it. I think that the attention focused on education by the presidential commission and the media has helped to make the time ripe for business to enter. I speak with some experience, since I now teach mathematics and computer science at the college level. The emphasis placed on computers and high technology has created an anxiety among the general public to the point where those people unacquainted with computers either fear them or feel guilty about it. I have several friends who have made decent amounts of money by conducting private classes in Basic and in the operation of specific home computers.

I think that video disks—the interactive kind—would be fantastic educational media. There is now out an arcade game using interactive video disks and the kids line up ten deep waiting to use it at the arcades. Compared to standard video games, the graphics (or effective memory) of these things is really astounding.

On a slightly different subject, I think that if a simple and reliable packet node controller could be developed to the point where it was a black box whose use was transparent to the user, it would revolutionize both the ham-radio and the home-computer communities. With the popularity of computer networks such as Compuserve and The Source and with drastic rises in local telephone rates imminent, the time will very soon be ripe for both a digital (no-code) license and PACSAT-type satellites.

Warren Ziegler KI1E/2
Staten Island NY

DR. DIGITAL

Robert Swirsky AF2M
PO Box 122
Cedarhurst NY 11516

ON LANGUAGE

At a recent meeting of the WA2DCS computer club, John KI2U asked me if I was working on any interesting computer projects. John always expresses interest in my programming endeavors; perhaps it's because I tend to write unusual programs. I have been known to spend months doing some of the weirdest things ever done with a computer (at least by means of a program).

One of my favorite projects that I finished this past year was an adventure game called "Time Warp." This program needs three interconnected computers to run, not to mention a sound system. The game is based on the movie, *The Rocky Horror Picture Show*, and the objects are to save Dr. Frank N. Furter from death and to lead some other characters to safety. I'm not so sure if my results were worth the effort, but at least I gained some insight on how to interconnect computers to handle a distributed processing task.

Another of my favorite programs was an absolutely silly piece of PL/I code to play the game "dots." (I'm sure you know how to play dots—two players take turns connecting dots in a grid. The player who can make the most boxes wins.) This program was written on punch cards for an IBM 370 computer. As I had no interactive terminal at my disposal, I had to look at the output to see what move the program made and then punch my move on a card and resubmit the program deck to the computer operator. A complete game took about 4 hours to play. It played a pretty good game, and as far as I know, nobody else has ever analyzed this game before. Maybe I'll start something. (First Pacman, then Q-bert, and now, dots!)

My latest major project on a computer was an implementation of the programming language SNOBOL for microcomputers. After I informed John of this, he asked this thought-provoking question: "Why can't you develop a special ham-radio computer language?" He gave me some thoughts on what such a language might contain—Morse, Baudot, or ASCII I/O statements, as well as interrupt handling, I/O buffering, math functions for metric conversion, and "great circle" functions.

I didn't feel that ham-radio applications warranted their own language. After all, the things that John suggested could be handled with a subprogram library. Nevertheless, the suggestion started a lively discussion among our club members. So let's hear what you think about the matter. If anyone has suggestions on what a ham-radio computer language might include and what the structure might be, drop me a line. It would be interesting to see if there is a need for such a thing.

The issue of computer languages is, in itself, a hot topic. I am frequently asked what the best language is or what the easiest language is. Unfortunately, there are no answers to these questions, but because this subject generates such interest, I will devote some space to matters regarding languages and compatiblity among computers.

Everything—

—you've always wanted to know about assembly language and... A number of people have written me asking about assembly language. The question I have been hearing most is how one should go about getting started with it. "It just seems so darn *complicated*" is the common cry of distress. As I tend to use many assembly-language programming examples, some people have commented that they felt lost while reading through a listing.

My reason for using assembly language is simply that there is no other way of doing certain things with a computer. When one uses a so-called "high-level" language such as Basic or FORTRAN, one finds oneself shielded from the machine. You are, so to speak, a few levels removed from the hardware of the machine. Unfortunately, this lack of intimacy between user and machine prevents the user from establishing complete control. One must be happy with how the interpreter or compiler chooses to do certain things. (Please pardon my anthropomorphism; it simply makes the sentences less cumbersome.) Like most others, I like to take the easy solution to a problem. In many instances, assembly language *is* that easy solution.

My own first experience with assembly language came from a course I took at Hofstra University: CS 110. The course assumed some prior PL/I programming knowledge and made the student realize that computers worked on a much *simpler* level than PL/I. Of course, everyone realized that the mechanism for the computer's understanding of PL/I was a program called a "compiler," but not too much thought was given to that fact. The compiler was simply regarded as a "black box." Nobody cared how it performed its black magic; the only thing people concerned themselves with was what went in and what came out.

The point of this diversion is that assembly language is *simpler* than any other programming language. That's right—simpler! The instructions are very primitive: Move a byte of data, add two binary numbers, compare a number to zero. In fact, while microcomputers usually have at least fifty different instructions, only a few are needed. The late computer scientist, Alan Turing, proved that only a few very primitive operations on binary data would suffice to compute any problem that a better equipped (i.e., a larger instruction set) machine could handle. In particular, all a computer needed were the basic logical operators and a branch statement.

With all this historical information aside, it is time for us to consider the matter of a painless approach to learning assembly language. First, get it out of your mind that this is a complicated matter. It is, in fact, a simple one—so simple that people tend to make it much more difficult. Let's start at the beginning.

In the beginning, there was machine language. Programmers would program by punching holes or flipping switches corresponding directly to memory locations in the computer. This was a tedious affair, but engineering and math types were content with this method for a number of years.

The instructions that a computer program consists of are represented as numbers in the computer's memory, and the same memory is used for both data and instructions. That means that the contents of a byte containing the binary number 10101010 could be anything from a computer instruction to a data item. One cannct tell the exact meaning of an isolated byte of memory—it must be looked at in context.

Needless to say, this business of binary numbers soon got confusing. It was extremely difficult to debug a program consisting solely of spots on a storage tube, or perhaps binary numbers represented in base 16 or base 32. Because of this, assembly language was developed.

Assembly language and machine language are very closely related. There is a one-to-one correspondence between statements written in the two languages. It is best to think of assembly language as a tool for writing machine-language programs. Much of the tedious memorizing and mathematical calculating that a programmer must take care of when programming in machine language are dutifully performed by the assembler.

The primary function of the assembler is to provide a set of mnemonic codes for the binary instructions of the computer. It is much easier to remember that BNE means "branch if not equal to zero" than that 01001100 means jump to the memory location specified by the next two bytes.

Assembly language also allows the user to work with decimal or hexadecimal numbers; conversion from one radix to another is another function handled by most assemblers. Finally, an assembler allows a person to create a program to run in various parts of memory. A machine-language program generally cannot be relocated to another portion of memory. An

assembly-language program can be placed into another portion of memory by reassembly of the program.

Each microprocessor has its own machine language and, therefore, its own assembly language. For example, the Atari computer and the Apple computer both use a microprocessor chip in the 6502 family. Because of this, they both have the capability of "understanding" the same assembly language. The obvious conclusion a person could make is that those two machines would be software compatible, at least at the machine-language level. Unfortunately, this conclusion is erroneous.

There is another factor to consider when dealing with software compatibility: differences in hardware. Let's continue with the Apple vs. Atari comparison and look at some of the hardware differences. Consider the simple matter of the clock speeds of the computers. The Atari's internal clock, which controls the speed of the microprocessor, runs at about 1.8 MHz as compared with the 1.024 of the Apple.

Does this mean that the same machine-language program will run 56% faster on an Atari? No! The Atari will be about the same speed, if not slower, because of Atari's special display processor chip. This chip takes control of the computer's bus every so often in order to fetch display data from memory. In order to do this "direct memory access" (DMA) of data, the 6502 microprocessor must be "halted" during the DMA cycle.

Another thing that slows down the computer's performance is Atari's use of interrupts. Every 60th of a second, and sometimes more often, the microprocessor is interrupted from the program that it is executing and runs a system-maintenance routine. All this interrupt and DMA business simply means that the amount of time the Atari computer takes to execute a program cannot be calculated by simply knowing the clock speed, nor can the speed of the computer be compared to another computer's just by looking at the clock frequency.

The reason that we have to consider hardware when dealing with assembly language is that one cannot separate the two. It is necessary to have some hardware knowledge in order to program effectively in assembly language. This is especially true when doing I/O-related tasks. After all, how can you get data into or out of a computer without knowing the hardware configuration?

Just keep in mind that assembly language is simpler than any other language. Think small. Each statement can do only very little. If you approach the matter with this attitude, you will find learning assembly language to be equally simple.

High-Level Languages

High-level languages remove the user from the computer's hardware. Many things that an assembly language must worry about are "shielded" by the language processor. It is this shielding that makes some things impossible to do in a high-level language; sometimes complete control is needed. However, most of the time a high-level language (such as Basic) is the better choice. The easiest solution is often the high-level language.

A wide variety of high-level languages is now available for microcomputers. In addition to Basic, implementations of C, PL/I, Algol, Pascal, FORTRAN, LISP, Ada, COBOL, PL/M, Forth, and Logo are commonly available. I will devote some time to these and comment on their suitability for amateur radio applications in future months.

Graphics

I still need more feedback on the development of a graphics standard for amateur radio. As I mentioned in past columns, I would like to establish some standards to allow users of different computers to exchange graphics data. Possible techniques could include "unit square" graphics (where coordinates are given relative to a 1 by 1 screen thereby making the center point 0.5,0.5) or standard graphics character sets. Any comments along these lines would be appreciated. Don't forget: Include an SASE to ensure a reply!

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

BASIC ELECTRONICS

I've just finished looking through the FCC's new list of suggested questions for Novice-class exams. Most of the material looks pretty good. Still, it comes off looking kind of dull—row upon row of gray boilerplate. I can't help but think that the FCC could have done better by coming to me. Boy, would I have put together a test for them—you know, crossword puzzles, matching, acrostics, and so on. Don't laugh. Is it any sillier to make prospective hams memorize a binary code system? ASCII code yes, Morse code no. At least my puzzles would have a relevance to current technology, which is more than you can say for those silly dits and dahs.

Taking things a step further, imagine the new look in study guides. Page after page of puzzle solutions. Can't you just see Dick Bash at the Dayton Hamvention hawking his *Final Exam Crossword Dictionary*?

Hey, FCC! I can still help you with the General, Advance, and Extra-class tests lists. Drop me a line.

ELEMENT 1
MULTIPLE CHOICE

1) An electrical generator's magnets are:
   1) small
   2) non-polarized
   3) oppositely-polarized
   4) similarly-polarized
2) What is the current value in the circuit of an 8-Watt lamp running at 200 volts?
   1) 0.04 Amps
   2) 40 Amps
   3) 400 Amps
   4) .4 Amps
3) The henry is the unit of:
   1) work
   2) voltage
   3) capacitance
   4) inductance
4) Impedance is:
   1) the total opposition offered by a circuit to the flow of alternating current
   2) the total opposition offered by a circuit to the flow of direct current
   3) the complete resistance offered by a circuit to ac or dc
   4) determined by dividing voltage by resistance
5) The two most common semiconductor materials are:
   1) germanium and curium
   2) silicon and argon
   3) iron and lead
   4) germanium and silicon
6) Transistors can:
   1) amplify voltage
   2) amplify current and voltage
   3) amplify current
   4) none of the above
7) The banded end of a diode indicates the:
   1) anode
   2) cathode
   3) emitter
   4) filament
8) A multivibrator is a type of:
   1) Hartley oscillator
   2) Armstrong oscillator
   3) Colpitts oscillator
   4) resistance-capacitance oscillator
9) A disconnected capacitor:
   1) is harmless
   2) does not contain energy
   3) can be used as a transistor
   4) can kill you
10) D'Arsonval:
   1) was the inventor of the transistor
   2) is a type of analog meter
   3) is a type of digital meter
   4) refers to D'Arsonval's Law

ELEMENT 2
MATCHING

Match the term to its definition.

Column A	Column B
1) Acorn	A) Diode rectifier
2) Klystron	B) Unit of work
3) Nuvistor	C) Squat UHF tube
4) Dyne	D) Miniature metal/ceramic tube
5) Newton	E) Microwave tube—has a bunch cavity
6) Magnetron	F) Air-filled VLF tube
7) Phototube	G) Microwave diode
8) Mercury-vapor tube	H) Miniature tube with pins extending from its ends and sides
9) Thyratron	I) Gas triode or tetrode
10) Doorknob	J) Converts light energy to electrical energy
	K) Unit of force

ELEMENT 3
TRUE-FALSE

	True	False
1) The daraf is the unit of elastance.	____	____
2) Doubling a number and adding one is called "dibbling."	____	____
3) One handy oscilloscope use is the measurement of capacitors.	____	____
4) The coulomb is the unit of quality.	____	____
5) In magnetism, opposites repel while likes attract.	____	____
6) A "zig-zag" is a type of rectifier circuit.	____	____
7) A "zener" can be used as a voltage regulator.	____	____
8) There are two individual rectifiers in a bridge rectifier.	____	____
9) Batteries generate voltage through photosynthesis.	____	____
10) A logic probe is used to test 5-volt dc circuits.	____	____

ELEMENT 4
FILL IN THE BLANK

1) A_____is a precisely dimensioned, hollow metal pipe through which microwave energy is sent.
2) The instrument that presents visual representations of an electrical quantity is an _____.
3) The soft form of carbon used in most resistors is called_____.
4) The main control electrode in a vacuum tube is the_____.
5) In a bipolar transistor, emitted current travels toward the_____.

THE ANSWERS

Element 1:
1-3, 2-1, 3-4, 4-1, 5-4, 6-2, 7-2, 8-4, 9-4, 10-2.

Element 2:
1-H, 1-E, 2-D, 4-B, 5-K, 6-B, 7-J, 8-A, 9-I, 10-C.

Element 3:

1—True	It measures the opposition of the capacitor to be charged. Incidentally, "daraf" is farad spelled backwards.
2—True	Not to be confused with "dribbling," which is a basketball term.
3—False	By studying its waveform, I guess.
4—False	Quantity.
5—False	It's the other way around.
6—True	A variation on the three-phase, half-wave star theme.
7—True	Zener diode.
8—False	Four.
9—False	Plants use photosynthesis, batteries generate voltage with chemicals.
10—True	Computer circuits.

Element 4:
1—waveguide
2—oscilloscope
3—graphite
4—grid
5—collector

SCORING

Element 1:
Two and one-half points for each correct answer.
Element 2:
Two and one-half points for each correct match.
Element 3:
Two and one-half points for each correct answer.
Element 4:
Five points for each word correctly filled in.

Are you up on your basics?
1-20 points—Your Bash is showing.
21-40 points—Good thing the FCC doesn't re-test.
41-60 points—Qualified for your license class.
61-80 points—Time to upgrade?
81-100 points—Obviously, you hold an MSEE degree.

REVIEW

THE YAESU FT-980 TRANSCEIVER

As transceivers became completely solid state, size and weight were reduced dramatically, so I was particularly surprised at the FT-980, the latest descendant of the Yaesu FT-line. This now-famous line began with the FT-400 and became perhaps most popular with the FT-100 series. But the FT-980 HF Transceiver CAT System (for, I suppose, computer-aided transceiver) is no lightweight and it's packed full of features aimed at providing the serious radio amateur with the best communications tool available. For this review, along with the FT-980 I had the optional SP-980 speaker system and the MD-981 stand microphone. More about these accessories later. General specifications for the transceiver are shown in Table 1.

Packed in with the set was a pretty good installation and operation manual that explains the rig's capabilities. The manual included a couple of loose sheets that detail connections for an alternate means of keying a linear amp if it requires more than 200 mA of switching and updated filter installation instructions. Because this FT-980 had all the optional AM and CW filters already installed and I was trying to key a linear with current requirements less than 200 mA, these provided no extra trouble—and I doubt they would anyway.

The manual is reasonably well written and doesn't contain many misspellings and odd sentence structures typical with some imported equipment. Separate from the manual are 22 pages of schematics and 7 pages of block diagrams! If you have the "right stuff" to tear into the FT-980, at least you'll have a fighting chance with this documentation. Also in the manual is a thorough description of accessory interconnection along with pinouts for each plug and connector. An added bonus in the package is a nice four-color map of Japan for award use; it's in Japanese, though.

So much for the documentation—let's get this unit on the bench and start operating. "Oof," says I. "This thing weighs a ton." Actually, it weighs close to 40 pounds with all the options installed. In the shipping box I found a bag of all kinds of plugs and connectors, tilt feet, fuses, three-wire line cord, and two AA-cells for the power-off memory retention. The AA-cells were the first of several oddities. Memory backup is provided solely through these cells—no nicads, lithium cell, or anything else. Yaesu says to replace them every six months or "adios" to the FT-980's memory.

As with several other available "competition-grade" transceivers, the FT-980 covers all the amateur bands, including WARC, and acts as a separate 150-kHz-to-29.9999-MHz general-coverage receiver. With the memory backup energized, upon power-up the FT-980 greets you exactly as you last left it. Should you elect not to use the memory back-up or should the AA-cells fail, the 980 defaults to 7.000 MHz, general coverage.

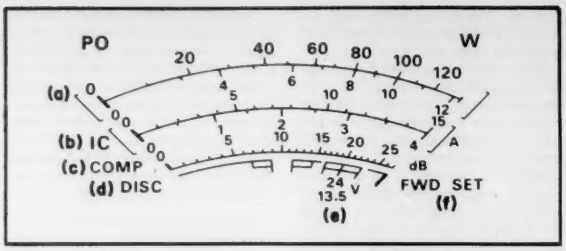
Rocking the power switch on illuminates the two large analog meters and the blue digital frequency/mode displays. The meters provide quite a monitoring capability as shown in Fig. 1. The upper digital display includes frequency readout to 10 Hz as well as USB, LSB, CWN (narrow), CWW (wide), AMN, AMW, FSW, and FM, to match the position of the Mode switch.

Receive Features

To operate, first select Ham or Gen(eral) coverage by depressing the appropriate push-button. Band selection is made through three momentary-contact push-buttons: Up, Down, and Repeat. These as well as most other functions are selected via momentary-contact push-buttons that function either as toggles (push-on/push-off) or as simple entry switches. A soft beep verifies that switch contact has been made and the beep can be turned off.

Operating frequency can be selected five ways: 1) main tuning knob, 2) 10-kHz/step push-button, 3) Up/Down 5-kHz push-buttons, 4) a keypad, and 5) up to 12 memory frequencies selected by a rotary switch. Yaesu's optional stand and hand-held microphones afford frequency selection via push-buttons, although without as many options.

Upon power-up, I was impressed with



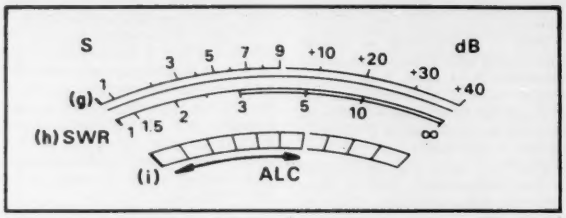


Fig. 1. Details of the FT-980's two multifunction meters: a) power output in Watts (output of 10-Watt low-power version of FT-980 is read on bottom of this scale); b) output-transistor transmit current (all modes); c) SSB speech processor compression; d) center-scale tuning for FM reception; e) Vcc safe zone; f) swr forward set mark; g) S-meter; h) swr scale; i) safe alc zone for SSB.

TRANSMITTER

Frequency Range

Band	Frequency (MHz)
160	1.5–1.99999
80	3.5–3.99999
40	7.0–1.49999
30	10.0–10.49999
20	14.0–14.49999
17	18.0–18.49999
15	21.0–21.49999
12	24.5–24.99999
10	28.0–29.99999

Emission Types
LSB,USB (A3J/J3E)
CW (A1/A1A)
AM (A3/A3E)
AFSK (F1/J1B)
FM (F3/F3E)

Power Output
(Watts, all bands)

SSB, CW	100 (PEP)
AM	25
FM, FSK	50

Maximum FM Deviation
+5 kHz

AFSK Shift
170, 425, 850 Hz

Output Impedance
50 Ohms, unbalanced

Frequency Accuracy
Better than +3 ppm

RECEIVER

Frequency Range
150 kHz to 29.99999 MHz, continuous

Circuit Type
Triple-conversion superheterodyne

Image and I-f Rejection
Better than 70 dB

Dynamic Range
Better than 95 dB with 300-Hz CW filter

Audio Peak Filter Range
350-1400 Hz

I-f Notch Filter Range
(demodulated)
500–2700 Hz

Selectivity
(Adjusted for maximum i-f width)

Mode	−6 dB (width in kHz)	−60 dB (width in kHz)
SSB,CW (W/N), FSK	2.5	4.2
CW (narrow)	0.3	0.6
CW (wide)	0.6	1.2
AM (no filters)	6.0	17.0
AM (wide)	5.0	12.0
AM (narrow)	3.0	9.0
FM	12.0	24.0

POWER REQUIREMENTS

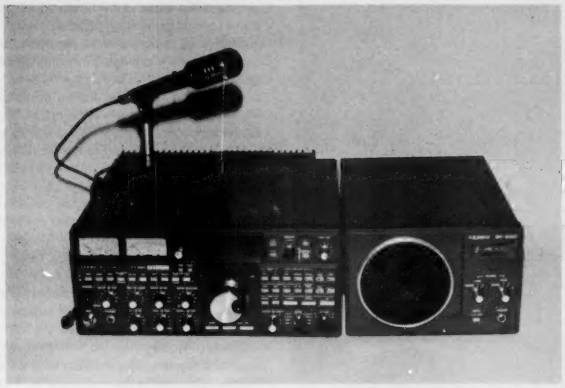
Voltage
Ac: 100 to 120 volts or
200 to 234 volts
50–60 Hz

Power Consumption
Receive: 72 VA
Transmit: (100 Watts out): 530 VA

Physical Characteristics
Overall Dimensions:
15 inches wide
6-1/2 inches high
18-1/2 inches deep
Weight:
Approximately 38 pounds

Table 1. General specifications for the Yaesu HF Transceiver FT-980 CAT System.

Fig. 2. Comparison of the digital (top) and analog (bottom) "sub-display" arrangements. The digital display is straightforward; the analog one is inscrutable.



The Yaesu FT-980 with companion mike and speaker.

Operating side of the FT-980. The curious pseudo-analog display is right above the main tuning control (more on this in the text and Fig. 2).

the audio quality of the receiver. It has an excellent built-in speaker. When the accessory speaker or headphones are plugged in, the internal speaker is disconnected.

On receive, you have AF gain, RF gain, Noise Blanker, Tone, Squelch (FM only), i-f Width and Shift, wide and narrow filters (if installed), a calibrated 0–30-dB rf attenuator (in 10-dB steps), a Mode switch, and Notch and APF (audio peak filter—CW only) controls to play with. You can do some pretty fine knob-twiddling and slice away at the pileups and heterodynes. The narrow filters are very sharp and a dial-lock push-button holds the frequency in case you accidentally bump the main tuning knob while tweaking all the other controls.

The frequency displays require some special mention. Beneath the upper digital frequency and mode display is another window, a sub-display that Yaesu calls a "...synthesized analog display [that] provides a relative frequency indication which scrolls when the frequency of the selected vfo is changed." What it amounts to is a digital simulation of an analog dial display of frequency. See Fig. 2. It's confusing; I couldn't find a single reason for its being there. Because a digital frequency display accurate to 10 Hz is right above it and this pseudo-analog display is accurate only to 1 kHz, I'm curious as to Yaesu's intentions. And while speaking of displays, a Dim push-button reduces meter and display brightness by about half for low-light or nighttime operating.

Other controls include push-buttons for transmit and receive clarifiers that actually use the main tuning control. This is a little strange if you are used to a separate clarifier knob. Also included are push-buttons for selecting which vfo (ham or general coverage) will be used for transmit (ham only) or receive (either) or which memory channels will do the frequency controlling. Split-frequency operation is possible, along with push-buttons to give you the difference between vfo and memory channel frequencies. It's relatively easy to store and retrieve a memory frequency, but it's too complex to describe here all the possible interactions, shifting, and operating options available. This transceiver does *not* have a built-in scan capability, but you can store, retrieve, and exchange memory and vfo frequencies handily. In place of a bfo control, there's a rear-panel CW pitch slide switch that selects 500, 600, or 700 Hz as the CW receive tone.

One thing that I really did miss was a WWV calibration control. Yaesu must figure that the synthesizer is right on because there is no way that I could find to adjust zero-beat with WWV. The specs say frequency accuracy is better than 3 ppm for 0–40 degrees C (32–104 degrees F). That means WWV should only be about 30 Hz off at 10 MHz!

Transmit Features

Satisfied that I wouldn't do any damage, I next tried loading the FT-980—no problem. Power output is adjustable with a Drive control. I was, however, a little suspicious of the built-in swr metering circuitry when it indicated an absolutely flat 1-MHz bandwidth on the 10-meter elements of my triband quad. The swr monitoring circuitry will protect the finals, though, reducing power out to about 75 percent of available output power at ideal (1:1) conditions when a 3:1 swr is encountered. An on-demand fan cooling system is employed to control output transistor temperature.

This rig also had the Curtis 8044-chip-based keyer option installed and the whole system is set up for full break-in operation. I was a little disappointed at the speed control of the keyer, though. It seemed to have a very narrow realistic speed range but would go phenomenally high.

The FT-980 has a nice control and metering setup for speech compression. You can read dB of compression and use the Monitor control and a pair of headphones to adjust the processor for maximum punch and minimum distortion while listening to yourself. And an Automatic Mike Gain control enables you to set a modulation threshold to help eliminate background noise. Although a little tricky to adjust, these controls can give you tremendous audio capabilities.

Recalling memory frequencies and returning to your original frequency, using the transmit and receive clarifiers, and figuring out just what split frequencies you are on is a little confusing at first. The yellow LEDs next to some of the switches help, but because the radio can do so much, it's a little overwhelming. You eventually feel comfortable after getting to experiment for a while. Three Tab push-buttons can be employed on transmit and receive to limit the frequency excursion between a high and low limit you select. As the manual states, possible uses for this feature include limiting operation to legal bands or subbands of an operator's license class.

An FSK Shift slide switch on the rear panel selects shifts of 170, 425, or 850 Hz while the mark tone stays at 2125 Hz. Power output is limited to 50 Watts for FSK as well as FM, 25 Watts on AM.

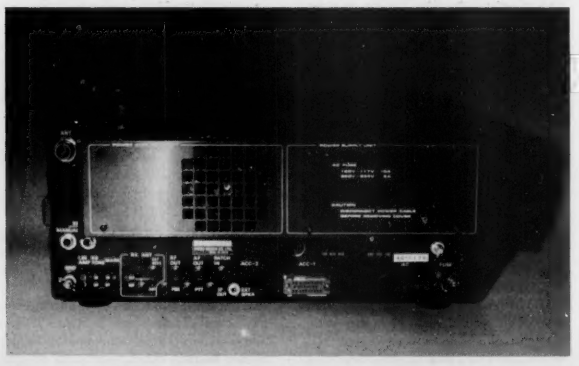
SP-980 Remote Speaker

This outboard speaker not only complements the FT-980, it also adds some more knobs to twiddle during receive.

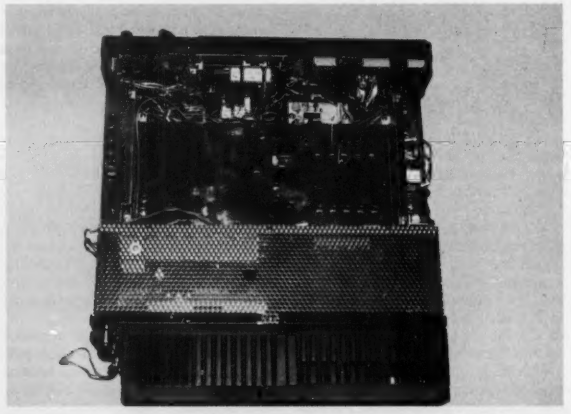
Built-in passive L-C circuits are switched in and out of the circuit via front-panel selector switches. Response curves on the front panel show the bandpasses produced as the Low and High filter switches are clicked through their ranges. An input switch enables you to select from two separate audio inputs, and there's also a Phones jack. Combined with the Tone switch on the transceiver, the filters provide an extra dimension in receive capability. All in all, a nice addition to the station.

MD-1 Microphone

Yaesu's penchant for buttons and switches carries over into their "stand" microphone. In addition to a standby/transmit switch located on the mike itself, the rig's Up/Down/Fast frequency-select



Rear panel of the FT-980 has almost as many switches as the front panel. The projecting module holds the power amplifier (left) and the power supply (right).



Top view of the FT-980. The optional keyer module is the small rectangular PC board located at about the one-o'clock position. The vco, PLL, and vfo subassemblies are under the metal covers. Power supply and control circuitry are under the screened-in section at the rear.

buttons are duplicated on the mike stand, just in case you're comfortably settled into your easy chair and can't quite reach the tuning buttons on the rig. There's also push-to-talk and lock switches, a high (50k-Ohm)/low (600-Ohm) mike impedance switch, and a three-position tone switch. The mike can be easily removed from its cradle stand but the short cord limits your mobility. An optional MH-1 hand-held mike also is available that includes Up/Down/Fast push-buttons and a two-position tone switch.

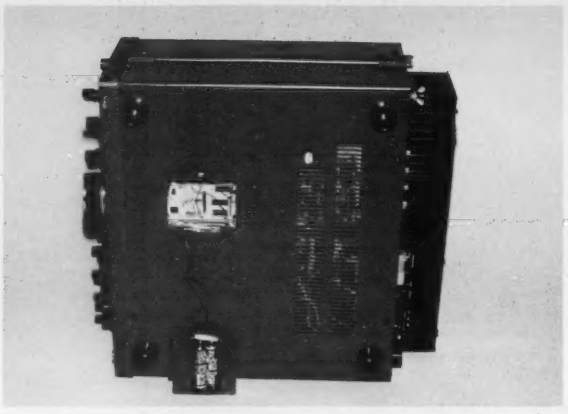
Conclusion

I really liked the FT-980. While it's designed with the serious amateur in mind, it also can help simplify the operating position because it can include a keyer, swr monitor, FM circuitry for transverter drive, full break-in QSK switching circuitry, a separate receive-only antenna switch, and a full array of interface connectors. It also has rear-panel jacks that access its internal microprocessor and a serial interface that allows external control via an outboard microcomputer. Unfortunately, details other than plug pinouts and some cryptic signal names are not provided. So you'll just have to experiment (carefully).

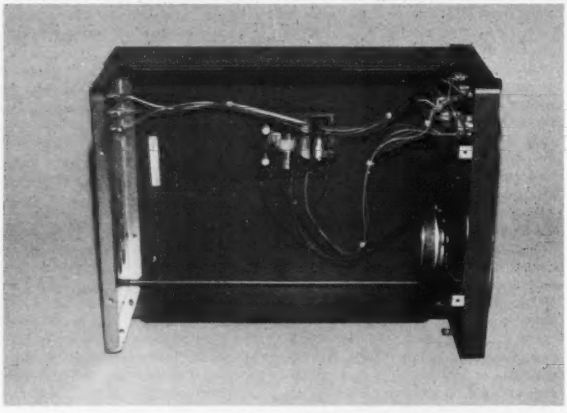
The current crop of amateur transceivers offers tremendous flexibility, along with capabilities unheard of a few years ago. The penalty for this is increasing cost and initial bewilderment when confronted with the maze of controls and switches. But get your hands on an FT-980 and spend some time getting used to it. I think you'll find this is one nice piece of equipment.

For more information, contact *Yaesu Electronics Corp., 6851 Walthall Way, Paramount CA 90723, (213)-633-4007.* Reader Service number 476.

Gene Smarte WB6TOV
Hancock NH



Bottom view. The small door to which the memory backup-supply AA-cells mount dangles free. The circuitry on this side is the i-f (left) and the rf (right). Most of the rig is fairly accessible.



Inside the SP-980 speaker. If you've ideas for station accessories, you have plenty of room here.

DX HIDDEN ASSET LOOP ANTENNA

H. Stewart Designs has just introduced a new antenna design called the DX Hidden Asset Loop Antenna. What you get for $12.50 are the *plans* to build the antenna and a *complete description* of the antenna itself, including history, performance, configuration, construction, and installation. It is called the DX Hidden Asset Loop because it is capable of working DX, it can be installed indoors and is thus "hidden," it is undeniably a loop, and it is an asset to your station. Read on and find out how we proved to our satisfaction that this antenna is well-named.

73 received a prototype antenna that had been made up by H. Stewart Designs to illustrate the construction materials and method of assembly. They even included a wooden mounting support!

Jim Gray W1XU asked me if I would be interested in reviewing the DX Hidden Asset Loop Antenna for *73*. I readily agreed. Not knowing what to expect, I went to work.

After opening the package, I discovered that I had a support board with vertical antenna sections already attached, two antenna loops, each consisting of three pieces of small-diameter aluminum tubing, connectors, clamps, four corner pieces with clamps, and one set of plans and instructions.

With the vertical elements already attached to the support board (which had all the necessary holes pre-drilled), it was easy to insert the four corner pieces (tubing elbows) through the holes provided and slide them over the ends of the vertical elements. The required distance between the two loops (39.5") was already pre-marked on the support board, so the next step was to clamp these pieces in place with the hose clamps.

Next, I assembled the loops themselves by butting the three pieces of tubing in the connectors and clamping them with the hose clamps. Then, I inserted the ends of each loop into the four elbow pieces to a depth indicated by black tape wrapped about 9" from each end and clamped them in place for a first trial. This resulted in an assembly that looked like two large basketball hoops, one above the other, attached to the board and connected to each other by a pair of vertical elements spaced a few inches apart, forming a loop at each end of the board. The instructions said that the antenna should resonate at 28.5 MHz if the dimensions were followed exactly during assembly. However, depending upon the environment in which the antenna is erected, it is possible that the resonant frequency will be slightly different due to house wiring, plumbing, proximity to power lines, etc. (In my case, with the antenna in the attic, no changes had to be made.)

I attached the vertical support board to a horizontal two-by-four that I nailed to the attic rafters. Now it was time to connect the coax to the parallel vertical elements. One of these is separated by about an inch in the middle, forming a gap across which the coax is fastened. The shield braid of the coax goes to one side (lower) of the element, and the center conductor goes to the other (upper) side. Soldering is easily and quickly accomplished. The coax was then led away from the antenna at right angles for about ten feet (instructions say for at least a half-wave—16 feet—for best results) and then downward through a plastic conduit to my shack in the basement.

After that, I was ready to get on the air, but I felt that a test of swr should be made first, so W1XU brought over his bridge. Applying power at 28.1 MHz (the lower end of the 10-meter Novice band), the swr came out at less than 1.5:1, so I decided not to change anything. Now for the on-the-air test!

Within an hour's time, I worked two Texas stations on 10 meters. The band had just opened, yet one station gave me a 579, and the other (a few minutes later) gave me a 599! This was with about 70 Watts output from my FT-707.

Just for fun, we switched to 40 meters to see if we could receive anything there. Signals were jumping! So, what the heck, it couldn't hurt to see if the antenna loaded on 40, could it? Believe it or not, it did, even though the swr was high. The FT-707 has a shut-down circuit in the final to protect it from overload, but I found that the output was still about 50 Watts . . . so I went ahead and called CQ. I worked one ham in Maine and another in New York, with a 559 and a 589, respectively! I was hooked on the DX Hidden Asset Loop Antenna. Even on 80 meters, the reception I get is remarkable, but I haven't had the nerve to try transmitting on 80.

I feel that the antenna is highly suited for emergency and Field Day communications and is ideal for the ham who lives in an apartment or condominium or otherwise must put up with limited space. The DX Hidden Asset Loop Antenna occupies a space only about six feet square and four feet high, so I can highly recommend it for any ham who has a space problem. Not only that, it works out like gangbusters on ten, so you will really have a DX antenna—I'm sure.

General Description

In essence, the DX Hidden Asset Loop Antenna is a single quad loop turned in upon itself. It retains the quad's characteristics of quiet reception, low cost, and ease of assembly. However, its configuration is such that it can be installed in a roughly cubical space that is approximately equal to one-sixth wavelength on a side at the operating frequency. The only other requirement is that the selected installation site permit the coax to be brought away from the antenna at right angles for at least one-half of an electrical wavelength.

One of the features of the DX Hidden Asset Loop Antenna is direct feed with 50-Ohm coaxial cable without an antenna coupler or matcher required. (We think that its performance would certainly not be hurt in the least by the unbalanced feed recommended, but, if desired, a balun could be installed at the feedpoint to ensure balanced feed of this balanced antenna.) The antenna is very broad-banded; you can expect a useful bandwidth of about 3 to 5 percent of the resonant frequency, meaning that on ten meters, it will cover between 500 kHz and 1 MHz from the resonant frequency. By sliding the adjustable-length pieces in and out, you can set the resonant frequency anywhere you want it in the band. Typically, the swr at resonance will be 1.5:1 or less, and it is probable that you will be able to get it below 1.2:1 with careful tuning. However, if the antenna is mounted close to conductors like house wiring or copper plumbing, you may have trouble getting the swr as low as otherwise possible. One good feature is that H. Stewart Designs covers these contingencies in the plans and instructions and tells you how to make the necessary adjustments to compensate.

The only comment that might be considered a negative aspect is that the DX Hidden Asset Loop Antenna is not yet available in kit form! You will have to make up your own kit from the instructions and plans . . . which won't be at all difficult to do. We hope that H. Stewart Designs will consider offering this unique and practical antenna in kit form later on, because we think they have a winner. I'm sure you will think so, too, after you build yours. Plans and instructions are $12.50 from *H. Stewart Designs, PO Box 643, Oregon City OR 97045.* Reader Service number 478.

Ross Kenyon KA1GAV
73 Staff

BENCHER KEYER PADDLE

One of the great delights of CW is the beautiful "music" that can be generated by a good operator using good equipment. Today's CW operator has the advantage of a variety of keys and keyers to choose from, most of which have full iambic capability. As you know, iambic-mode keying allows certain characters to be formed more easily and quickly. For example, letters like F, L, Q, Y, and so forth require

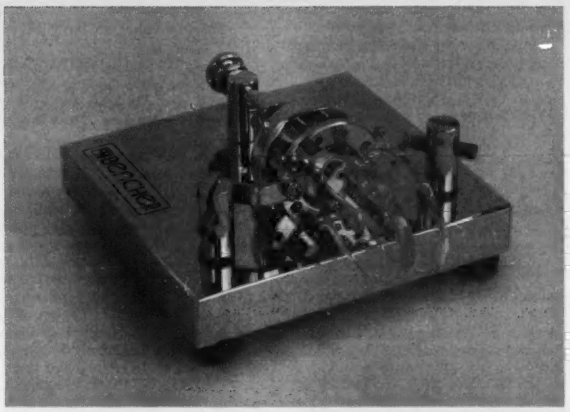
fewer paddle movements when keyed in the iambic mode.

Many operators have discovered the Bencher full-iambic keyer paddle, suitable for use with all of the electronic keyers and well known for its functional beauty. In fact, I have been using a Bencher paddle since 1979 and find that I like it better and better each year. It seems to be settling in...or perhaps I am the one that's settling in! Unfortunately, I never learned iambic keying, and I use the key in the ordinary bug fashion. Just the other day I was talking with Bob Locher W9KNI, who —with Jerry Benedict— is a partner in Bencher, Inc. (*Bene*dict plus Lo*cher* = *Bencher.*) I lamented the fact that I had never learned iambic keying and therefore wasn't making full use of my paddle. Bob laughed and said, "You're not alone, but we have just developed something for hams like you and for hams who are used to a bug—a non-iambic paddle for use with either full-iambic or non-iambic keyers."

We chatted a while longer about keys, keyers, and paddles, and, after a bit of adroit arm-twisting on my part, Bob finally knuckled under and promised to send me one of the new paddles, realizing perhaps that I was one of the last old-fashioned holdouts who could never learn iambic CW. Maybe he just took pity on me.

Whatever the reason, I soon received a large box full of plastic worms. Buried within the plastic protection was a smaller box enclosing the key. Inside that box I found a cardboard partition or separator that holds the very heavy paddle base in place and prevents the relatively delicate paddle mechanism from being dislodged and damaged during shipment. The entire package is neat, strong, and extremely well designed...a hint about the contents, too!

The key itself looked much like the original—only better, if that is possible. It has



Model ST-2 Bencher paddle.

a heavy chrome-plated base with rubber feet that keep the key solidly in place on your bench or desk and inhibit its walking around when energetically operated. The paddles and their unique gimballed actuating mechanism are supported on sturdy pillars screwed into the base. The finger pads are clear plastic ovals (as opposed to triangles on the original Bencher paddles) with chamfered, or bevelled, edges that invite your fingers to slip over them while keying...providing a very nice feel.

The tension spring is very easy to adjust on this model because the spring loop is captured by an adjustable screw with a knurled knob at the center post. The contact space adjustment between paddles and slide posts is made as before, with Allen screws and lock screws set into the posts. Bencher has thoughtfully supplied the Allen wrench for you, attached to the underneath side of the base, where it can't get lost. Perfect spacing adjustment and tension, suited to your own specifications, can be obtained quickly and easily the first time you try.

The two sides of the key, that is, the paddle electrical contacts, are brought through the base by insulated bushings to solder lugs attached by 10-32 Phillips-head screws. The ground side of the key is a solder lug firmly screwed to the base itself. There is also a plastic retainer that firmly holds the lead wire from your paddle to your electronic keyer. The wire is not provided, of course, but the one you use now will be satisfactory. I use a vinyl-covered, double conductor, shielded cable...similar in size and appearance to a microphone cable, or a piece of coax. After the electrical attachments are made to the solder lugs, the cable is clamped down so that the connections can't pull loose.

You'll find the Bencher paddle easy and pleasant to use...it seems to invite your fingers to use it easily and correctly. In my own case, I was extremely pleased to find that I stopped making keying errors through misuse of the iambic feature. My CW improved perceptibly, if not dramatically. I think you'll like your new Bencher paddle, especially if (like me) you don't know iambic keying, yet you want a key that will enable you to get the most out of your electronic keyer and make beautiful "music."

The Bencher paddle, Model ST-1 (black-finished base), is available at $46.95 amateur net. Model ST-2 (chrome-finished base) is priced at $59.95, and Model ST-3 (gold-plated base, available on special order) costs $150.00. Write to *Bencher, Inc., 333 West Lake Street, Chicago IL 60606.* Reader Service number 477.

Jim Gray W1XU
73 Staff

WHAT DO *YOU* THINK?

Have you recently purchased a new product that has been reviewed in *73*? If you have, write and tell us what *you* think about it. *73* will publish your comments so you can share them with other hams, as part of our continuing effort to bring you the best in new product information and reviews. Send your thoughts to Review Editor, *73: Amateur Radio's Technical Journal*, Peterborough NH 03458.

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

It's February, and, not to offend the followers of your friendly neighborhood groundhog, I'd like to celebrate Valentine's Day this year. A Valentine to all of you readers, who send me the most interesting mail.

I would like to lead off with a note from Peter Martinez G3PLX of AMTOR fame. In part, Peter writes, "I am glad to see that interest is picking up over there after such a long time. It seemed for many years that AMTOR was strictly a European system.

"It is true that in the early days of AMTOR, I was offering a program that would run AMTOR on a 6800-based computer, but this was written in source code only and was incomplete in that it required all the interfacing to the computer hardware to be written. There were very few people able enough to use the program in this form.

"So this program is no longer available, and I turned my attention at that time to designing a small PCB, with on-board CPU, ROM, etc., which would enable people to get on the air much easier than tackling the difficult software task. The Mk2 version of this kit is still available from ICS Electronics Ltd, PO Box 2, Arundel, West Sussex, England, either in kit form or as a ready-made board. It requires a single 5-volt supply, and will interface at TTL serial Baudot code to any existing RTTY system.

"I think you will see that the initial approach to AMTOR in its early days 5 years or so ago has fallen by the wayside and given way to others. There are not, as then, very many experienced machine-code programmers amongst the amateur-radio fraternity, and most users now and in the future will prefer to buy ready-made hardware or software. There will be no shortage of either before very long."

I do appreciate these comments, excerpted from a much longer letter written by this pioneer of AMTOR.

Bill Emerson WA1EVD, D.M.D., passes along his comments that he would like to see a compilation of RTTY Loop columns and also that, "I hear more AMTOR now, but 60-wpm Baudot is still the common mode. Lingua Franca?" I suspect that Murray, or Baudot, will remain such for quite a while, Bill. With the number of machines out there, I doubt if the "sixty standard" will soon roll over and die.

Nonetheless, several of you are expressing various forms of interest in computerized RTTY. Lester L. Johnson AH6AA of Sandpoint, Idaho, relates having built a demodulator from an article in an old issue of *73*. He couples that with a commercial AFSK oscillator and a TRS-80(R) computer, model unspecified. Lester would like a way to interface his computer to the terminal unit and such. He notes that the I/O structure of the Model I TRS-80 is different than the Model III; but does not say which he has. I do not have any ready information to accomplish this, Lester, but I am sure that a number of our readers have. Let me hear from you out there, and I will publish the best schemes for all to benefit.

Lester also notes that he would like to run his rig, a Kenwood TS-120, on RTTY, with the power cut back to about ten Watts. I would say, off the top of my head, that this should be okay. Normally, cutting the power back to that extent should be sufficient to protect the finals from overheating. I have run my 100-Watt transmitter at about 50 or 60 Watts for prolonged periods without damage, but I like to take chances!

Another computer user is Anson R. Hyde K4EK, M.D. Dr. Anson, who lives in Alexandria, Virginia, just over the river from Washington DC, has used his IBM-PC on two-meter ASCII RTTY using a telephone modem to output tones. He would like to know if there are any programs around to run Murray on this machine. Well, that is one machine that I have seen *nothing* for RTTY printed on. I don't know if IBM-PC users are not the "hamming" type (I suspect that they are not) or if the average ham is looking for a more modestly priced machine (so that that is where the manufacturers concentrate their marketing), but RTTY for the IBM-PC? Zip! I would encourage anyone who has put together such a program to write it up and send it to me here for inclusion in a future column, or make it a full-scale article and send it to our fair editor. We're waiting, we're waiting!

Greetings to Dean E. Strand KAØKKZ of Davenport, Iowa. Dean passes along a string of thoughts, a few of which I shall share with you all. Dean notes that he is using a Robot 800 keyboard, and when using it on CW in the Novice bands, he likes to set it to send characters at ten words per minute, with five-word-per-minute spacing. He feels that this makes the code more copyable and helps the newcomer improve his code speed. I agree, Dean, and this has even been the way the best code tapes are made.

Dean writes he has difficulty tuning in stations using a dedicated scope display on his terminal unit. Well, in an edition of this column several years ago, I covered how to hook up a general-purpose oscilloscope to act as a tuning device for RTTY. All you need are mark and space signals out of your demodulator. Feed them to the vertical and horizontal input of any old scope and tune the "+" pattern to maximum. Cheap scopes can be picked up at most hamfests and can be used for other things when not tuning in a RTTY signal.

Like all of us, Dean is looking to computerize his station. He notes that "there are at least two ways to go, one to get a good general-purpose computer (when I say good, I mean DEC Rainbow, IBM-PC, or HP Professional class, not VIC or Atari

stuff) and use and interface...that includes AMTOR. The other way would be to get a...top-of-the-line unit...with all the whistles and bells." Now hold on, Dean. I think you might find that the top-of-the-line computers you mentioned might just be overkill for a ham shack. Don't knock the cheap stuff. I just got another small computer in here, a TRS-80C (also known as the CoCo), and am amazed at what can be done. The 6809 is a fantastic chip that can run rings around many other systems. If you want a big computer for business use or such, fine, but don't sell the little stuff short. It ain't so little anymore.

Leonard Laurel WA6FBL of Fort Bragg, California, is one of those with what might be considered a small system. He is looking to hook up his TI-99/4A on RTTY. Well, Len, as I write this column, the newspaper is filled with the news of Texas Instruments' decision to stop production of the 99/4A, so I don't know what the future holds. As with the IBM-PC, I have seen next to nothing in print about using the 99/4A on RTTY. I only hope that someone out there is doing it and sending the information in to be passed along. Good luck.

From the "left hand don't know what the right hand is doing" department comes a note from Karl Thurber W8FX from Millbrook, Alabama. Karl asks, "Have you run into anyone who has successfully interfaced a Commodore VIC-1525 printer to a Hal CT-2100 Communications Terminal? The Commodore printer (which is the standard one used commonly with the VIC-20 and C-64 computers) has a so-called 'Commodore serial ASCII' bus, while the CT-2100 has provisions for an 'ASCII printer' and 'RS-232C' output, neither of which appears to be suitable for connection to the 1525 printer without some sort of interface. A letter to Hal brought a 'we know nothing about that printer' response, so I'm stymied at this point."

The first thing which occurs to me is to check that both devices are operating at the same baud rate. It is possible that one may be set at, say, 110 baud—like for a Teletype KSR-33—where the other may be at 300 or1200 baud, such as most serial printers are. Also, check to see if the Ready To Send (RTS) and Clear To Send (CTS) lines are used to inhibit and enable print, and, if so, that they are hooked up correctly. Without some sort of documentation, those are my first suggestions. Perhaps others have done this hookup and will let us know. I have confidence in you all out there!

Several of you in your letters suggested that a book compilation of the first several years of this column would be helpful. I agree with you, but it will take more than your notes to me and my intentions to make such a book a reality. Drop a line to the editor of *73*, and to me as well, and let us know that there are enough of you out there interested to make a go of it. In the meantime, keep up with all the new developments yet to come. With the arrival of the CoCo here in the shack, I hope to be able to take a look at some of the 6809 software that has been floating around beyond my reach for a while. As soon as I see it, I'll tell you about it—right here, in RTTY Loop.

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

ARIZONA QSO PARTY
Starts: 1800 GMT February 4
Ends: 0600 GMT February 5

Sponsored by the Southern Arizona DX Association. Single-operator and club entries; all bands and modes but no repeater contacts allowed. Each station may be worked only once per band per mode.

EXCHANGE:

RS(T) and state, province, DXCC country, or Arizona county. Novices and Technicians also sign /N or /T respectively.

FREQUENCIES:

Phone—3895, 7230, 14280, 21365, 28560.

CW—60 kHz up from lower band edge.

Novice—25 kHz up from lower band edge.

SCORING:

Count 1 point per phone QSO, 2 points for each CW or other mode QSO, and 4 points per QSO with Novice or Technician in the Novice bands. Arizona stations multiply QSO points by number of states, provinces, and DXCC countries. Others multiply QSO points by number of Arizona counties (15 max.). The club station W7NQ also counts as 1 multiplier for non-Arizona stations. Non-Arizona stations working all Arizona counties and W7NQ may double the multiplier.

AWARDS

Certificates for the highest-scoring station in each category: Arizona, non-Arizona, and Novice/Technician. In addition, certificates for highest score in any Arizona county, state, province, or DXCC country in which there are entries.

Other certificates for Arizona and non-Arizona clubs whose members' scores combine for the highest score. Club entries must consist of at least 5 individual entries to be eligible. Club residency is determined by mailing address.

ENTRIES:

Individual entries should show each station worked, exchange plus time, frequency, and mode of each QSO. Include a summary sheet of your scoring and dupe sheets for bands with more than 50 QSOs. Entries may designate one club with which they are participating. Deadline for individual entries to be received is March 4.

Club entries should be submitted by a club officer with a summary of callsigns and claimed scores. To be counted toward the club total, the individual entries must also designate the club. Deadline for club summaries is April 4.

Include a large SASE for results. Entries should be addressed to: Southern Arizona DX Association, c/o Philip M. Stickney N7BUP, 1890 West Paseo Cuenca, Tucson AZ 85704.

ZERO DISTRICT QSO PARTY
1900 GMT February 4 to 0100 GMT February 5 and 1500 GMT February 5 to 2400 GMT February 5

Sponsored by the Davenport Radio Amateur Club. Stations outside of Zero district will work Zero stations only, Zeros may work any station. The same station may be worked once on each band (80, 40, 20, 15, and 10 meters only) and each mode (CW and phone). However, mobile stations may be worked each time they change counties.

EXCHANGE:

RS(T) and ARRL section. Zero-District stations also must send county.

FREQUENCIES:

3560, 7060, 14060, 21060, 28060, 3900, 7270, 14300, 21370, 28570, 3725, 7125, 21125, and 28125.

SCORING:

Each phone QSO is worth one point; CW QSOs are worth two points. Non-Zero-District stations multiply by the number of Zero-District counties. Zeros multiply QSO points by the total ARRL sections, Zero-District counties, and DXCC countries worked.

ENTRIES & AWARDS:

A plaque will be awarded to the high scorer in the Zero District and high scorer from outside Zero Land. Certificates will be awarded for high scores in each ARRL section, DXCC country, Novice/Technician class, and mobile categories. Results and a participation certificate will be issued to all entrants who include an SASE. Mail logs by March 10 to W@BXR, 2131 Myrtle, Davenport IA 52804.

SOUTH CAROLINA QSO PARTY
Starts: 1800 GMT February 4
Ends: 2359 GMT February 5

The QSO party is again sponsored by the Colleton County Contestors. The same station may be worked on each band and mode, simplex only. South Carolina mobile stations that change counties are considered new stations. Novice and Technician stations please sign /N or /T.

EXCHANGE:

RS(T) and state, province, country, or South Carolina county.

SCORING:

Phone contacts are worth 2 QSO points; CW contacts are worth 3 points. The multiplier for South Carolina stations is the number of states, provinces, and DX countries worked. Others multiply QSO points by the number of South Carolina counties worked (46 max.).

FREQUENCIES:

Phone—3895, 7230, 14280, 21365, 28560.

CW—3560, 7060, 14060, 21060, 28060.

Novice—3725, 7125, 21125, 28125.

AWARDS:

Certificates to top-scoring station in each South Carolina county, state, province, and DX country. Novices and Technicians compete only with other Novices and Technicians.

ENTRIES:

Include a summary sheet with your entry showing scoring and other information. Indicate each new multiplier in your log as it is worked. Novices and Technicians must indicate class on entry. Include a large SASE for results. Send entry by March 5 to: Colleton County Contestors, c/o Elliott Farrell, Jr. KE4VP, Rt. 3 Box 658, Walterboro SC 29488.

VERMONT QSO PARTY
2100 GMT February 4 to 0700 GMT February 5 and 1100 to 2400 GMT February 5

Sponsored by the Central Vermont Amateur Radio Club (W1BD). Each station may be contacted once on each band and mode (CW, phone, RTTY). CW and RTTY contacts must be in the CW and RTTY subbands.

CALENDAR

Feb 4–5	South Carolina QSO Party
Feb 4–5	Arizona QSO Party
Feb 4–5	Vermont QSO Party
Feb 4–5	Zero District QSO Party
Feb 4–6	New Hampshire QSO Party
Feb 11–12	Dutch PACC Contest
Feb 18–19	YL-ISSB Commo System QSO Party—Phone
Feb 18–19	ARRL DX Contest—CW
Feb 18–20	America Radio Club International DX Contest
Feb 24–26	CQ Worldwide 160-Meter DX Contest—SSB
Feb 25	RTTY World Championship Contest
Mar 3–4	ARRL DX Contest—Phone
Mar 17–18	YL-ISSB Commo System QSO Party—CW
Mar 17–18	Bermuda Contest
Mar 17–18	Spring QRP CW Activity Weekend
Jul 13–15	A5 International SSTV-DX Contest
Aug 11–12	New Jersey QSO Party
Aug 24–27	A5 North American UHF FSTV-DX Contest
Sep 22–23	Late Summer QRP CW Activity Weekend

RESULTS

1983 ARIZONA QSO PARTY CERTIFICATE WINNERS

ARIZONA STATIONS

Call	QTH	Score
K6LL	Yuma County	75,468
KB7KZ	Pima County	16,965

NON-ARIZONA STATIONS

W5PWG	Texas	200

EXCHANGE:

QSO number and state, province, country, or two-letter designator for Vermont county (AD, BE, CA, CH, ES, FR, GI, LA, OE, OS, RU, WA, WM, WR). Do not send RS(T).

FREQUENCIES:

Phone—3910, 7230, 14260, 14320, 21360, 28570, 50.110, 144.2.

CW—3530, 3730, 7030, 7130, 14060, 21060, 21160, 28060.

RTTY—3620 and **090 other RTTY subbands.

SCORING:

Score one point per phone contact, 2 points per CW or RTTY. Vermont stations multiply QSO points by number of states plus Canadian provinces plus ARRL countries (exclude US/Canada). Others multiply QSO points by the number of Vermont counties (14 max.).

AWARDS:

For non-Vermont stations, certificate to highest-scoring station in each state, province, and country. Certificates will be given each Vermont station submitting a log; annual plaque to highest-scoring Vermont station. W/VT Award given to stations working 13 of Vermont's 14 counties.

ENTRIES:

Send an SASE for official log and score sheets. Send logs/facsimiles, name, class of license, and address not later than March 1 to: D. Nevin KK1U, W. Hill, Northfield VT 05663. Include an SASE for a copy of the results.

NEW HAMPSHIRE QSO PARTY
1900 GMT February 4 to 0700 GMT February 5 and 1400 GMT February 5 to 0200 GMT February 6

Sponsored by the New Hampshire Amateur Radio Association. Stations may be worked once per band per mode. New Hampshire stations may work each other.

EXCHANGE:

Send RS(T) and country, ARRL section, or New Hampshire county, as appropriate.

FREQUENCIES:

Phone—3935, 3975, 7235, 14280, 21380, 38575, 50.115, 145.015.

CW—1810, 3555, 7055, 14055, 21055, 28055.

Novice—3730, 7130, 21130, 28130.

RTTY—3625, 7085, 14085, 21085, 28085.

SCORING:

New Hampshire stations score 1 point per QSO, multiplied by the number of ARRL sections plus countries plus New Hampshire counties. Others score 5 points per New Hampshire QSO times the number of New Hampshire counties worked.

ENTRIES:

Send your entry no later than March 15 to Pete Cantara K1IM, 19 Haverhill St., Hudson NH 03051. Include a large SASE for results.

DUTCH PACC CONTEST
Starts: 1400 GMT February 11
Ends: 1700 GMT February 12

Use all bands, 160 through 10 meters on CW and SSB. No crossmode operations allowed. Each station may be worked only once per band regardless of mode. Operating categories include single operator, multi-operator, and SWL.

EXCHANGE:

RS(T) plus sequential QSO serial number starting with 001. Dutch stations will send their two-letter province abbreviation instead of a QSO number: GR, FR, DR, OV, GD, UT, YP, NH, ZH, ZL, NB, and LB.

SCORING:

Each QSO with PA, PB, or PI counts one point. Multiply QSO points by the number of provinces worked on each band (72 max.).

SWLS count one point per Dutch station heard and multiply by provinces heard on each band (72 max.).

ENTRIES:

As usual, a score calculation is required. Please use a multiplier column and insert multipliers only if new. A log must be signed for observations of the contest rules. SWL logs must contain condegroups given by the Dutch station and the foreign station worked with. Send logs no later than March 31 to: F. Th. Oosthoek PA0INA, PO Box 499, 4600 AL Bergen op Zoom, Netherlands.

A certificate will be awarded to each country winner in each category along with the second- and third-place stations provided that there are sufficient participants in that country. Certificates will also go to winners in each call district of JA, LU, PY, UA9/0, VE/VO, VK, W, ZL, and ZS.

AMERICA RADIO CLUB INTERNATIONAL DX CONTEST
Starts: 0500 GMT February 18
Ends: 0500 GMT February 20

Any amateur station making two contacts with America Radio Club DX member operators during the two-day contest will be eligible to apply for the Special Silver QSL Award. Stations making three contacts will be eligible for the Special Gold QSL Award. Contacts must be made during the two-day period listed above. Suggested frequencies include all authorized frequencies in the 10-, 15-, 20-, and 40-meter phone and CW bands. Exchange RS(T) and QTH. SWL stations may also apply for this award on a heard basis. For special awards, send QSL and $2.00 in US funds or 6 IRCs to: America Radio Club QSO Contest, PO Box 3576, Hialeah FL 33013.

YL-ISSB COMMO SYSTEM QSO PARTIES
Phone
Starts: 0001 GMT February 18
Ends: 2359 GMT February 19
CW
Starts: 0001 GMT March 17
Ends: 2359 GMT March 18

Use the General portion of all bands. Deadline for all logs, summary sheets, and comments is June 1. Entries should be addressed to: Rick and Minnie Connolly, Star Route 1, Crocker MO 65452. Individuals needing extra application and instruction forms send a 4 × 9 SASE to the same address.

CQ WORLDWIDE 160-METER CONTEST — SSB
Starts: 2200 GMT February 24
Ends: 1600 GMT February 26

Operating classes include both single and multi-operator (maximum of 5 ops per station).

EXCHANGE:

RS plus QTH, state for USA, and province for Canada.

SCORING

Contacts with stations within own country are 2 points, other countries but same continent are 5 points, other continents are 10 points. KH6 and KL7 are considered countries.

Multipliers are each US state, VE province, and DX country. USA and Canada are *not* country multipliers. However, there are three VE1 provinces: New Brunswick, Nova Scotia, and Prince Edward Island. Final score is total QSO points times the sum of the multipliers. Maritime mobile scoring will be determined by the location.

AWARDS:

Certificates to the top scorers in each class in each US state, VE province, and DX country. Special plaques are also being awarded for top USA, Europe, and world scores.

PENALTIES:

Three additional contacts will be deleted from the score for each duplicate, false, or unverifiable contact removed from the log. A second multiplier also will removed for each one lost by this action.

Violation of the rules and regulations pertaining to amateur radio in the country of the contestant or the rule of the contest, or unsportsmanlike conduct, or taking credit for excessive duplicate contacts or multipliers will be deemed sufficient cause for disqualification. Disqualified stations or operators may be barred from competing in *CQ* contests for a period of up to three years.

ENTRIES:

Sample log and summary sheets may be obtained from *CQ* by sending a large SASE with sufficient postge to cover your request. It is not necessary to use the official form, you can use your own. Logs should have 40 contacts per page and show time in GMT, numbers sent and received, and separate columns for QSO points and multipliers. Indicate the multiplier only the first time it is worked.

Include a summary sheet with your entry showing the scoring and other essential information, and a signed declaration that all rules and regulations have been observed. Mailing deadline for SSB entries is March 31. Logs can be sent directly to the 160 Contest Director, Don McClenon N4IN, 3075 Florida Avenue, Melbourne FL 32901 USA. Alternatively, they can be sent to *CQ* 160-Meter Contest, 76 North Broadway, Hicksville NY 11801 USA. Please indicate "SSB" on the envelope!

3RD ANNUAL RTTY WORLD CHAMPIONSHIP
0000Z to 2400Z
February 25, 1984

SPONSORED BY:

73 Amateur Radio's Technical Journal and *The RTTY Journal.*

OPERATOR CLASSES:

(A) Single operator, single transmitter. (B) Multi-operator, single transmitter.

ENTRY CATEGORIES:

(A) Single band. (B) Allband, 10-80 meters.

MISCELLANEOUS RULES:

The same station may be worked once on each band. Crossmode contacts do not count. Single-operator stations may work 16 hours maximum, while multi-operator stations may operate the entire 24-hour period.

BEACON
INDIANAPOLIS REPEATER ASSOCIATION

NEWSLETTER OF THE MONTH

We think that the *Beacon* is one of the best newsletters we've ever seen. Basically, it is *packed* with information: news notes, hamfest and club calendars, bylaw excerpts, net skeds, reports from members and other media, contest and DX info, League news, a membership application, and more. You name it and it's in the *Beacon*—and it's presented in a very neat, easy-to-read format. Congratulations to Editor Mike Head WB9ZQE and the Indianapolis Repeater Association. The *Beacon* is a real winner.

To enter your newsletter in 73's Newsletter of the Month Contest, send it to *73*, Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

RESULTS

1983 DUTCH PACC CONTEST

USA WINNERS BY CALL AREA

	QSOs	Mult.	Score
K1KI	129	46	5934
WA2UDT	31	18	558
W3ARK	63	30	1890
W4VQ	106	37	3922
KN6O	8	5	40
N6ZX/7	11	7	70
WD8MGQ	28	20	560
W9OA	47	19	893
W0KZV	22	13	286

RESULTS

1983 A5 NORTH AMERICAN UHF-FSTV CONTEST

1	K6YGX/W6VCF	26,530
2	WB0ZJP	9,420
3	WB9MCF	5,440
4	W2WHK	4,520
5	KA0BVT	4,360
6	W2RPO	3,755
7	N2BJ	3,350
8	WA2CXW	2,815
9	WB2KGM	1,695

Off times are *no less* than 30 minutes each and must be noted in your log(s).

EXCHANGE:

Stations within the 48 continental United States and Canada must transmit RST and state or province/territory. All others must transmit RST and consecutive contact number.

QSO POINTS:

5 QSO points for contacts with W/VE stations located within the continental United States and Canada. 10 QSO points for all other contacts.

MULTIPLIER POINTS:

1 multiplier point is awarded for each of the 48 continental United States (a District of Columbia contact may be substituted for a Maryland multiplier), Canadian provinces/territories, and DX countries worked on each band (excluding US and Canada).

FINAL POINTS:

Total QSO points times total multipliers equals *claimed score.*

CONTEST ENTRIES:

Entries must include a *separate* log for each band, a dupe sheet, a summary sheet, a multiplier checklist, and a list of equipment used. Contestants are asked to send an SASE to the contest address for official forms.

ENTRY DEADLINE:

All entries must be postmarked no later than April 15, 1984.

DISQUALIFICATIONS:

Omission of the required entry forms, operating in excess of legal power, manipulating scores or times to achieve a score advantage, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification. Decisions of the contest committee are final.

AWARDS:

Contest awards will be issued in each entry category and operator class in each of the US call districts and Canadian provinces/territories, as well as in each DX country represented. Other awards may be issued at the discretion of the awards committee. A minimum of 25 QSOs must be worked to be eligible for awards.

CONTEST ADDRESS:

RTTY World Championship, c/o *The RTTY Journal*, PO Box RY, Cardiff CA 92007.

DX

Chod Harris VP2ML
Box 4881
Santa Rosa CA 95402

QATAR

One of several tiny countries around the Persian Gulf, Qatar's chief claim to fame is its black, gooey, crude oil under a barren landscape. Actually, Qatar is a peninsula sticking into the Persian Gulf from Arabia, not far from the island country of Bahrain. Most of Qatar's 4000 square miles are barren sand and low hills; annual rainfall is about 5 inches. Most of the country's 170,000 inhabitants live in the capital city of Doha.

As are most Middle Eastern countries, Qatar is antagonistic toward strangers. These countries are highly suspicious of foreigners and not only discourage but actually prohibit most visitors. (Consider Iran's feelings toward Americans, for example.) DXpeditions and amateur operations by foreigners living in these countries are seldom permitted, and few of the native amateur operators spend much time handing out DX contacts or QSL cards. So the report of an American with a well-equipped station active from Qatar is good news indeed.

Mike Smedal A71AD (Photo A) is the first foreigner to receive an amateur-radio license since the country became independent 14 years ago. To qualify for the license, Mike had to show that he worked and lived in Qatar, and he had to pass a security clearance. That done and the $250 license fee paid, A71AD was on the air.

Mike's station includes a Yaesu FT-1 transceiver feeding a Yaesu FL-2100Z amp. When conditions get a little rough, Mike runs the output of the Yaesu amp into an export version of Alpha's 77SX amplifier! The antenna farm is also first class (Photo B): a Hy-Gain TH7DDX above a Hy-Gain 402BA two-element 40-meter beam. An inverted V provides 80-meter coverage. Mike says that the TH7 handles the high-power levels without difficulty. Mike runs RTTY on his Radio Shack TRS-80 Model I and is active on OSCAR, too.

The best times to look for Mike (and other Middle Eastern amateurs) are Thursday evening and Friday. The work week is six days long in Qatar, with Friday (the Arab holy day) as the day off. So their equivalent to our weekend is Thursday night and Friday.

On the subject of QSL cards, Mike writes, "Please tell everyone that we do not have a radio club in Qatar. Therefore, we do not have a QSL bureau. If [DXers] want a QSL card, please QSL direct to PO Box 4747, Doha, State of Qatar, Middle East."

SAUDI ARABIA

An exception to the no-visitor policy of the Middle Eastern countries was made for the recent visit of Lloyd and Iris Colvin, W6KG and W6QL, of Yasme DXpedition fame. The Colvins managed not only to visit most of the countries in the region, but also actually obtained permission to operate in many of them.

Iris faced special problems in Saudi Arabia. Women occupy a very special role in the Arab world, quite different from that in the more liberal Western nations. Women are seldom seen out in public, and then only heavily veiled. Those few women who do venture out of doors find themselves escorted to the head of the line and receive other special attentions. On the other hand, an unveiled woman in Saudi Arabia faces a nasty surprise from the local authorities.

Saudi policemen carry two items on their belts: a can of black spray paint and an ice pick. Upon seeing a woman with bare face or arms, the policeman will, very politely, spray black paint over the exposed skin! (The ice pick sees similar service in the Saudi's swift, uncomplicated justice system. Illegally parked automobiles are not ticketed or towed. The policeman simply stabs all four tires with the ice pick!) And petty theft is unknown; the Saudis still cut off the hand of an offender.

In the amateur-radio field, most of the local hams are big wheels in the government or are in the Saudi family, which is the same thing. With the billions of dollars flowing into the country as the oil flows out, Saudi hams can afford good equipment. One local ham employs a graduate electronics engineer just to maintain his amateur-radio station!

However, the Saudi princes aren't likely to spend much time running stateside hams in pileups. One of your best bets to work Saudi Arabia is HZ1AB, the amateur-radio club at the American compound on the Persian Gulf, which is home in Saudi Arabia for about 50,000 foreigners. HZ1AB is another first-class station, with Collins S-lines, amplifiers, and a substantial antenna farm. The latter includes a rhombic, rotatable KLM tribander and a 2-element beam on 40 meters. The Colvins operated the ARRL CW DX Test from HZ1AB, but could work the States for only about 7 hours a day.

Among the regular operators of HZ1AB are Dave Ernest W7SE and N6OL. QSL the station through K8PYD, except for the February 19–20, 1983, operation by the Colvins, which is confirmed via Yasme, Box 2025, Castro Valley CA 94546.

Photo A. Mike Smedal A71AD in his well-organized and well-equipped shack in Doha, Qatar.

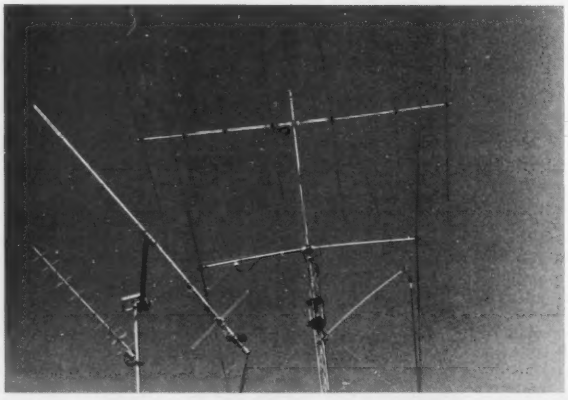


Photo B. The antenna farm at A71AD, including a TH7 and 2 elements on 40 meters. In the foreground are the Oscar 10 antennas.

QRO—EXCESSIVE POWER

Lloyd and Iris Colvin stopped by Houston between DXpeditions this past fall. At the International DX Seminar, held in conjunction with the ARRL National Convention, the Colvins joined several other prominent DXers and contesters on the panel discussion of excessive power in amateur radio. The problem of excessive power drew a large and interested crowd to hear the DXers discuss alternative solutions.

The seminar opened with a discussion of what we mean by "excessive power." Under the old FCC regulations, any amplifier was restricted to a maximum of about 800 Watts output. However, many of the "standard" off-the-shelf amplifiers openly sold in the amateur community were capable of significantly greater power levels, often 50% more. Active contesters and DXers owned amplifiers capable of running power levels above the FCC maximum because of the greater dependability and longer lifetime of an "over-rated" amp. A 1000-Watt amplifier running 1000 Watts all the time won't hold up as well as a 2000-Watt amp coasting along at half power.

However, there was always a strong temptation, particularly in DX pileups and contests, to run the amp flat out. "Tuning

Photo C. Gene Zimmerman W3ZZ (standing) makes a point at the Excessive Power seminar of the First International DX Symposium, in Houston. Al Slater G3FXB (left) and Bob Ehrhardt YS9RVE listen intently.

Photo D. Jim Smith VK0NS is aiming for Kermadec Islands this season, after his event-filled DXpedition to Heard Island last year.

for maximum smoke" is the usual practice, and many amateurs have run "excessive power" for years. Under the new FCC power regulations, most of these amplifiers have been "grandfathered" into legality.

But there is a greater problem in excessive power than squeaking out a couple extra Watts over the legal limit. While some amateurs are still saving their bucks for a better antenna, some hams have quietly been installing *real* high-power amplifiers, amps that require 500–1000 Watts of *drive*.

The Houston seminar turned to the problem of what to do about that small number of amateurs who run super-power. Frequent contester (and occasional DXpeditioner) Gene Zimmerman K3ZZ (Photo C) suggested that the current rules about power during contests be changed. Gene recommended that inspectors stop by the shacks of hams seriously involved in the contest and look at the amplifiers. If any amp had final plate dissipation (or the transistor equivalent) of more than 1600 Watts, the contestant would be disqualified. He reasoned that if you don't have an amp capable of running excessive power, you won't run it! The same idea holds for DXers, of course, with the offending amateur losing the right to participate in DXCC, for example.

Al Slater G2FXB (Photo C) talked about a similar program used by the Radio Society of Great Britain for their Field Day, which is even more popular there than the same activity on this side of the Atlantic. The RSGB requires each Field Day team to register before the contest and include their operating locations. During the contest, a volunteer RSGB inspector stops by and checks that the group is meeting their strict rules of 30 Watts maximum input power!

This 30-Watt limit poses special problems for British amateurs; most standard transceivers have little or no output at the 30-Watt input level. So the G hams build special final amplifiers designed for maximum output with 30 Watts of input power. These simple amps often are fed with a 100-Watt output transceiver and are run so close to the limit that some groups change final tubes every hour of the contest!

The question of high power is of special interest to Al, who spends much of his time on 160 meters, where the British hams face a 10-Watt power limit. Al said the government licensing authorities no longer worry about power and have suspended their station inspections. Most hams run a full 200 Watts on 160 meters, and 2000-Watt amplifiers are not unknown.

In other comments on the high-power question, panelist Ellen White W1YL felt that the contest rules already permit disqualification of anyone running illegal power. On the other hand, Ellen felt that the idea of inspectors coordinated from League headquarters would be unworkable. Ellen favored handling excessive-power users at the local level, by drumming them out of the local DX club, for example.

Both Iris and Lloyd Colvin recommended increasing the existing power limits as a means to eliminate the "excessive-power" problem. Lloyd particularly suggested higher power limits on the lower frequencies, including 160. Iris noted the advantages of high power on DXpeditions, when the power helps to control the pileup. If the stateside stations calling can't hear the DX station very well, the rate of contacts drops and fewer hams get a chance to work the DX station.

Several members of the audience took exception to the idea of ever-increasing power limits. Tod Olsen K0TO disagreed with the concept of letting the manufacturers of amateur equipment decide what the legal or moral limits to excessive power should be. "Just because it is openly sold to hams doesn't mean that the power level is acceptable." Dick Norton N6AA felt that in the contest field the power level doesn't really matter as long as the final contest results are not affected. But if someone wins the contest or moves ahead of a legal power station by running excessive power, he should be disqualified.

I have my own definition of "excessive power." The FCC amateur regulations state that amateurs should always use the minimum power necessary for the communications. So two hams talking across town on 20 meters don't need the amplifiers, much less the excessive-power amps. And frankly, even a few thousand Watts of power cannot compensate for bad operating techniques or inadaquate antennas.

How much power is *really* needed for amateur communications? Listen any time to 14100. A series of beacons all over the world ticks down every ten minutes with ever-lower power levels. See how far down into the mud you can copy the beacons' signals. We'll be talking more about this beacon network and other propagation aids and suggestions in future issues. Stay tuned. Meanwhile, keep an ear out for some of these coming attractions.

COMING ATTRACTIONS

The DXpedition circuit continues to hum in February, with two major expeditions scheduled for the month. Jim Smith VK0NS (Photo D) is spearheading an amateur and scientific DXpedition to the Kermadec Islands, a small, sparsely-inhabited group of volcanic islands about halfway between New Zealand and Tonga. Under the control of New Zealand, they have no special amateur call prefix.

The Kermadec Islands have been slowly moving up in the Most-Wanted-Countries list and now rank 17th, up with Spratly, Laos, and Clipperton. This DXpedition should satisfy a good chunk of that demand, with several operators and plenty of time on the island.

Jim Smith organized the Heard Island DX Association trip to Heard Island last winter and hopes for fewer problems on this year's DXpedition. Jim is also looking for donations for the trip and memberships in his Heard Island DX Association. Contact Jim via PO Box 90, Norfolk Island, South Pacific 2899.

Also scheduled for this month is a DXpedition to Aves Island, halfway around the world in the Caribbean. Isla de Aves (The Island of Birds) is a tiny part of a submerged reef about 150 miles west of the Windward Islands. The island is under the control of Venezuela, and the Venezuelan military restricts access most of the time.

The island itself is only about 1500 feet long and about 400 feet wide at the largest. Its maximum ten-foot elevation means it really is a large rock out in the middle of the ocean. Whenever the waves or tides are high in the Caribbean, landing on Aves is impossible. Only during a short period in mid-winter do calm conditions permit amateur operations.

Because of the restrictions and landing problems, DXpeditions to Aves are few and far between. Any station on the island is easy to work from the States, thanks to the excellent propagation from that part of the world. (Why do you think I lived there?) But you won't want to miss this DXpedition, as the next one might be years down the DX road. And Aves is already in the top 30 most wanted.

The DXpedition is sponsored by the Radio Club Venezolano, which is celebrating its 50th anniversary this year. The callsign on Aves will be YV0AA, with QSLs handled by YV5DFI, PO Box 50332, Caracas, Venezuela 1050-A, South America.

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We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared postcards and odd-sized scraps of paper. Please type or print your request (neatly!), double spaced, on an 8½"×11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye." and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

I'm looking for a schematic for a Lavoie oscilloscope, model no. LA265A. I will pay for copying and mailing costs.

L. C. Hocutt WE4O
4257 Via Alta Dr.
Mobile AL 36609

I am interested in obtaining the vox relay that plugs into the back of the Swan 700 transceiver. I would appreciate hearing from someone who may have one of these lying around that they don't have any future use for.

Augustus B. Wells
PO Box 50
Tunica LA 70782

I am looking for a copy of the instruction booklet for the Knight KG670 R/C tester made by Allied Radio. I will pay the costs for copying and mailing or for the original manual.

Lionel Roach KD5VO
3033 Teakwood
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Wanted: Collins 70E-7A PTO (permeability-tuned oscillator) for a Collins 75A1 receiver. This PTO covers 2–3 MHz and is used to tune the receiver.

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26 Linden St.
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(201)-436-1405

I am using the VIC-20 as a RTTY terminal with Kantronics interface and software. Can anyone help me with information on building an adapter which would let me use Atari cartridges on the VIC-20?

Robert F. Cann W4GBB
1606 Lochwood Dr.
Richmond VA 23233

I would appreciate receiving a copy of the schematic for an NCX-3 SSB/CW transceiver by National. I have the owner's manual already. I will gladly reimburse for costs.

Jeffry M. Blackmon W2YI
2107 Turnbull Road
Beavercreek OH 45431

I need the schematic for the Model TV-7D/U tube tester.

Stan LaDage W2EZM
431 Oakland Ave.
Maple Shade NJ 08052

I want to replace the tubes in my Collins R-392 receiver with solid-state devices. Any information on replacement parts would be greatly appreciated. I also need information on the R-392 Club and sources for 2-kHz filters for the Collins R-390A.

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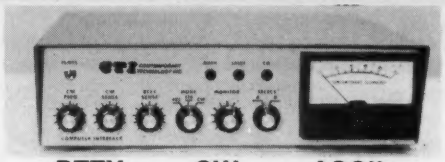

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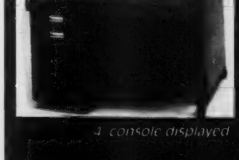

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W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 6

lem was not unique, that indeed the problem was universal and probably at the root of the general dislike of cocktail parties. I have a problem there. While I may hate meeting people and being expected to be entertaining on demand, I can't stay away from the food. I think I'd take a plane to the Shetland Islands if they promised me an interesting meal.

Much of my life has been an extended diet interspersed with fantastic meals which make the dieting even more imperative. About ten years ago I got fed up, if you'll pardon the expression, and went on a diet for about nine months. I lost 85 pounds, going from 250 bloated pounds down to 165. What an un-orgy that was! These days I hang around 175, not looking too fat, but feeling ten pounds overweight and guilty when gorging on ice cream, cake, and such.

Getting back to my ego: I wonder if my hopes to inspire you to greater things come across as ego? I delight in getting letters from people who have several basic drives: One is to educate and another is to share my enthusiasms. You may have noticed that all of my magazines are both educational and fun—expressions of my drives.

I don't *believe* that you can make all of the money you want, I *know* it. I hate it when I get letters complaining that, gee, I can't afford your magazine, a new rig, or something. What rot! There are so many ways to make money these days that just about anybody who wants to can do it . . . from kids right up to the retired.

No, if you are going to pursue a life goal of swilling several thousands of gallons of beer and seeing every Monday-night football game, you're a loser. You don't get rich very often without working hard at it. But you have to work with some goals in mind. A lot of people work their butts off and never get anywhere. The brutal fact is that, though not by any conscious design, this is the normal pattern. You do have to outwork the average person to make it big.

Why am I getting ready to invest several million dollars in a college? Here we are at a time when colleges are going out of business all around the country and I want to start a college! Dumb or shrewd? Well, I think I have a plan which will teach kids to become entrepreneurs and to beat the system. The end result will be a bonanza for our country and a few thousand more millionaires. Everyone will win.

There's Wayne's ego again? Well, perhaps—yet I've gone over my idea with the presidents of ten colleges now and haven't yet found one who doesn't think it will work. I'm getting quite a bit of support.

The average *73* reader is way above the average person in this country. It isn't easy to get a ham ticket, even with the Bash method, so that's a filter. And beyond that, the average *73* reader is another step ahead of the average ham just by virtue of his interest in keeping up with technology. The ham who does not read *73* has far less of an opportunity to be a success just because he doesn't take advantage of this remarkable resource.

From that aspect, I really feel sorry for the foreign hams who can't afford *73* or who are prohibited from subscribing because their money can't be sent away.

Most of my time is spent these days looking for people to help me with my projects. I really need help—enthusiastic, non-smoking help. My editorial a few months ago discussed this and resulted in a couple hundred letters. Some of those people are already here in Peterborough helping me get new projects started.

One enterprise, a franchise chain of software stores, is getting started. I have a whole new approach to the business which should make it possible for several thousand people to make an awful lot of money. It's an ingenious concept that no one else has thought of yet, so we have a very good chance, despite the recent proliferation of software stores.

Software Production Devices, Inc., is also moving along on schedule. This isn't my idea, but when I saw what two chaps from Bangkok had come up with and realized how desperately the computer industry needs the product, it seemed like a good investment. Indeed, I know of no other practical appoach to software protection, and I think I know 'em all.

I have several new magazines in mind which are needed, each to help a new industry to grow just as *Byte* and *Kilobaud* helped the microcomputer industry to flower. Magazines can't be started unless I have editors, writers, ad sales, circulation, administration, typesetting, production, photography, accounting, data processing, promotion, and so on. It takes about 25 people (minimum) to make a magazine work, and between the seven magazines we have now, the two of McGraw-Hill, and a half dozen others in the area, we've just about cleaned out southern New Hampshire of available talent. Interested?

A surprising number of the people we've been hiring of late are hams, fliers, and computerists—quite a combination for success, I suspect.

And speaking about proj-

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ects, a chap who used to work for me started his own computer mail-order business here in town and is already doing well over a million in sales per year. He started out with a small ad in *inCider*, my Apple magazine, and went over the million mark in sales the first month. I talk with him often...on the street, at the Folkway for lunch, or when he stops by my office.

He's a success because he did his homework and then had the guts to give it a try. The failures are those who spend their time watching TV, gossiping on the air, and wasting their lives. What a pity! Thousands of hams have used the hobby to get the technical smarts to develop new products and go into business with them. It only takes one good idea to make it.

That's one of my problems. I spend a good deal of my time staying abreast of the technology in communications and computers, with the result that I have a bright idea a day for a business...and a terrific idea a week. I lack only the people to help me make these ideas bear fruit.

A chap from Texas visited a few days ago. A ham, of course, a flier, and a computer nut. He was fascinated to see the high energy here, the people all working hard and obviously having one hell of a time. Sure, it's like a rabbit warren, but it's fun and very productive. People come here, often with little background, and they learn fast. Yes, he signed on and is moving here.

He found just what he wanted in a house in a couple of hours and is busy moving up here to help me start a new magazine. He's going to need a bunch of people to work with him...what are *you* doing? We're going crazy for people to help set type, paste up pages, shoot the pages into negatives, handle the circulation, and so on.

One of the new magazines I want to start will have as a goal the generation of several thousand new hams a year—maybe as many as 50,000 or even double that. No, I don't know of any way to let you work from home—you really have to be here.

Well, if you are all set with what you are doing, at least say hello on the air. I get a couple hours a week on 20m and my ego will be looking for you.

SATELLITES

PROJECT OSCAR

Project OSCAR, Inc., has prepared a new set of orbital predictions for the period covering the calendar year 1984. The predictions provide the UTC times and longitude for all south-to-north equatorial crossings of the 4 Russian satellites carrying Mode A transponders (RS5, RS6, RS7, and RS8). In addition, the UTC time and sub-satellite latitude and longitude are given for the apogee of each orbit of AMSAT OSCAR 10 (AO-10). This document, when used with the appropriate plotter, allows the user to determine the access times to all the presently available amateur-radio satellites carrying communication transponders.

The large expense incurred in producing and disseminating a calendar of this magnitude necessitates a request for a minimum donation of $10 for mailings to the US, Canada, and Mexico ($12 for all overseas mailings). To receive your copy of this set of orbital predictions, send a completed mailing label along with a check or money order payable to Project OSCAR, Inc., POB 1136, Los Altos CA 94022. The donation covers the cost of first-class mailing within the US, Canada, and Mexico, and airmail printed matter to overseas destinations.

Amateur Satellite Reference Orbits

Date	OSCAR 8 UTC	OSCAR 8 EQX	RS-5 UTC	RS-5 EQX	RS-6 UTC	RS-6 EQX	RS-7 UTC	RS-7 EQX	RS-8 UTC	RS-8 EQX	Date
Feb 1	0045	103	0114	292	0119	300	0058	291	0155	300	1
2	0049	104	0109	293	0104	298	0048	290	0153	301	2
3	0054	105	0103	293	0049	296	0039	289	0150	301	3
4	0058	106	0058	293	0033	294	0029	288	0147	302	4
5	0102	107	0053	293	0018	291	0019	287	0144	303	5
6	0107	108	0047	293	0002	289	0010	286	0141	304	6
7	0111	110	0042	293	0146	316	0000	285	0138	305	7
8	0115	111	0037	294	0130	314	0150	314	0136	305	8
9	0120	112	0031	294	0115	312	0140	313	0133	306	9
10	0124	113	0026	294	0059	309	0130	313	0130	307	10
11	0128	114	0021	294	0044	307	0121	312	0127	308	11
12	0133	115	0015	294	0029	305	0111	311	0124	309	12
13	0137	116	0010	295	0013	302	0101	310	0121	310	13
14	0141	117	0005	295	0156	330	0052	309	0119	310	14
15	0002	93	0159	325	0141	327	0042	308	0116	311	15
16	0007	94	0154	325	0126	325	0032	307	0113	312	16
17	0011	95	0148	325	0110	323	0023	306	0110	313	17
18	0015	96	0143	326	0055	321	0013	305	0107	314	18
19	0020	97	0137	326	0039	318	0003	305	0104	314	19
20	0024	98	0132	326	0024	316	0153	334	0102	315	20
21	0028	99	0127	326	0009	314	0143	333	0059	316	21
22	0033	100	0121	326	0152	341	0134	332	0056	317	22
23	0037	102	0116	327	0137	339	0124	331	0053	318	23
24	0041	103	0111	327	0121	336	0114	330	0050	319	24
25	0046	104	0105	327	0106	334	0105	329	0047	319	25
26	0050	105	0100	327	0050	332	0055	328	0045	320	26
27	0054	106	0055	327	0035	329	0045	327	0042	321	27
28	0059	107	0049	327	0019	327	0036	326	0039	322	28
29	0103	108	0044	328	0004	325	0026	326	0036	323	29
Mar 1	0107	109	0039	328	0147	352	0016	325	0033	323	1
2	0112	111	0033	328	0132	350	0007	324	0030	324	2
3	0116	112	0028	328	0117	347	0156	353	0028	325	3
4	0120	113	0023	328	0101	345	0147	352	0025	326	4
5	0125	114	0017	329	0046	343	0137	351	0022	327	5
6	0129	115	0012	329	0030	341	0127	350	0019	328	6
7	0133	116	0007	329	0015	338	0118	349	0016	328	7
8	0138	117	0001	329	0000	336	0108	348	0013	329	8
9	0142	118	0156	359	0143	3	0058	348	0011	330	9
10	0003	94	0150	360	0127	1	0049	347	0008	331	10
11	0008	95	0145	360	0112	359	0039	346	0005	332	11
12	0012	96	0140	360	0057	356	0029	345	0002	332	12
13	0016	97	0134	0	0041	354	0020	344	0159	3	13
14	0021	98	0129	0	0026	352	0010	343	0156	4	14
15	0025	99	0123	1	0010	349	0000	342	0153	5	15
16	0029	100	0118	1	0154	17	0150	11	0150	6	16

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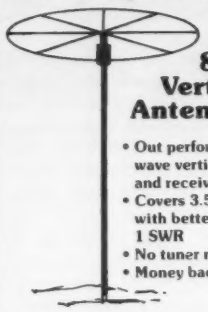

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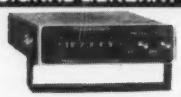

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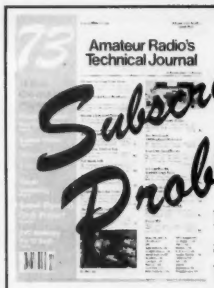

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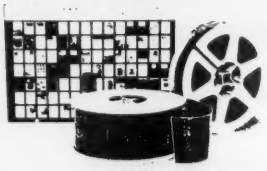

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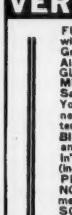

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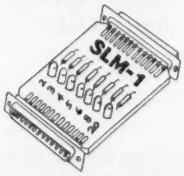

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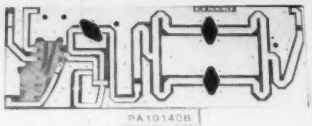

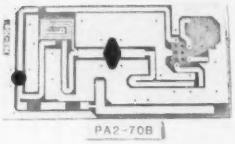

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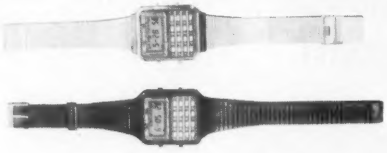

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Peak Pt. Voltage mv.	Vp	95Typ. 120max.	75Typ. 90max.
Projected Peak Pt. Voltage mv.	Vpp Vf=Ip	480min. 550Typ. 630max.	440min. 520Typ. 600max.
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2N5109	1.70
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PT6709	POR
PT6720	POR
PT8510	POR
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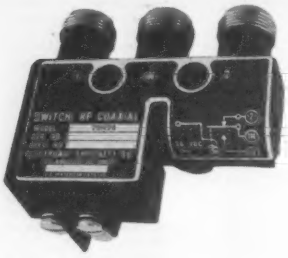
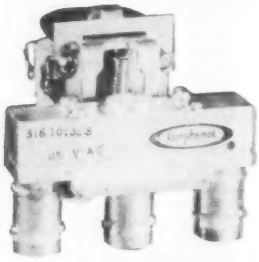
Part # 25N28 Part # SU-01
26Vdc Type N Connector, DC to 1 GHz.



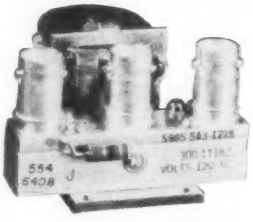
Amphenol
Part # 316-10102-8
115Vac Type BNC DC to 3 GHz.

$29.99



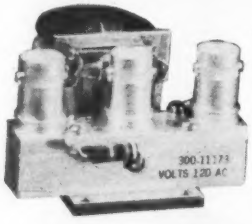
FXR
Part # 300-11182
120Vac Type BNC DC to 4 GHz.
FSN 5985-543-1225

$39.99



FXR
Part # 300-11173
120Vac Type BNC Same
FSN 5985-543-1850

$39.99



BNC To Banana Plug Coax Cable RG-58 36 inch or BNC to N Coax Cable RG-58 36 inch.

$7.99 or 2 For $13.99 or 10 For $50.00 $8.99 or 2 For $15.99 or 10 For $60.00

SOLID STATE RELAYS

P&B Model ECT1DB72 PRICE EACH $5.00	5vdc turn on	120vac contact at 7amps or 20amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.
Digisig, Inc. Model ECS-215 PRICE EACH $7.50	5vdc turn on	240vac contact 14amps or 40amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.
Grigsby/Barton Model GB7400 PRICE EACH $7.50	5vdc turn on	240vac contact at 15amps or 40amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.

NOTE: *** Items may be substituted with other brands or equivalent model numbers. ***

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RECALL PHONE MEMORY TELEPHONE WITH 24 NUMBER AUTO DIALER

The Recall Phone Telephone employs the latest state of art communications technology.It is a combination telephone and automatic dialer that uses premium-quality,solid-state circuitry to assure high-reliability performance in personal or business applications. $49.99

ARON ALPHA RAPID BONDING GLUE

Super Glue #CE-486 high strength rapid bonding adhesive.Alpha Cyanoacrylate.Set-Time 20 to 40 sec.,0.7fl.oz.(20gm.)
$2.00

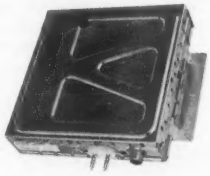
TOUCH TONE PAD

This pad contains all the electronics to produce standard touch-tone tones. New with data.

$9.99 or 10/$89.99

MITSUMI UHF/VHF VARACTOR TUNER MODEL UVE1A

Perfect for those unscrambler projects. New with data.



$19.99 or 10/$149.99

INTEGRATED CIRCUIT.		1 to 10	11up
MC1372P	Color TV Video Modulator Circuit.	$ 4.42	$2.95
MC1358P	IF Amp.,Limiter,FM Detector,Audio Driver,Electronic Attenuator.	5.00	4.00
MC1350P	IF Amplifier	1.50	1.25
MC1330A1P	Low Level Video Detector	1.50	1.15
MC1310P	FM Stereo Demodulator	4.29	3.30
MC1496P	Balanced Modulator/Demodulator	1.50	1.25
LM565N	Phase Locked Loop	2.50	2.00
LM380N14	2Watt Audio Power Amplifier	1.56	1.25
LM1889N	TV Video Modulator	5.00	4.00
NE564N	Phase Locked Loop	10.00	8.00
NE561N	Phase Locked Loop	10.00	8.00

FERRANTI ELECTRONICS AM RADIO RECEIVER MODEL ZN414 INTEGRATED CIRCUIT.

Features:

1.2 to 1.6 volt operating range.,Less than 0.5ma current consumption. 150KHz to 3MHz Frequency range.,Easy to assemble,no alignment necessary. Effective and variable AGC action., Will drive an earphone direct. Excellent audio quality.,Typical power gain of 72dB.,TO-18 package. With data. $2.99 or 10 For $24.99

NI CAD RECHARGEABLE BATTERIES

AA Battery Pack of 6 These are Factory New. $5.00

SUB C Pack of 10 2.5Amp/Hr. $10.00

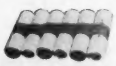
Gates Rechargeable Battery Packs

12vdc at 2.5Amp/Hr. $11.99
12vdc at 5Amp/Hr. $15.99

MOTOROLA MRF559 RF TRANSISTOR

hfe 30min 90typ 200max.
ft 3000mhz
gain 8db min 9.5typ at 870mhz
13db typ at 512mhz
output power .5watts at 12.5vdc at 870mhz.

$2.05 or 10/$15.00



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"SOCKETS AND CHIMNEYS"

EIMAC TUBE SOCKETS AND CHIMNEYS

SK110	Socket	$POR
SK300A	Socket For 4CX5000A,R,J, 4CX10,000D, 4CX15,000A,J	$520.00
SK400	Socket For 4-125A,250A,400A,400C,4PR125A,400A,4-500A,5-500A	260.00
SK406	Chimney For 4-250A,400A,400C,4PR400A	74.00
SK416	Chimney For 3-400Z	36.00
SK500	Socket For 4-1000A/4PR1000A/B	390.00
SK600	Socket For 4CX250B,BC,FG,R,4CX350A,F,FJ	51.00
SK602	Socket For 4CX250B,BC,FG,R,4CX350A,F,FJ	73.00
SK606	Chimney For 4CX250B,BC,FG,R,4CX350A,F,FJ	11.00
SK607	Socket For 4CX600J,JA	60.00
SK610	Socket For 4CX600J,JA	60.00
SK620	Socket For 4CX600J,JA	66.00
SK626	Chimney For 4CX600J,JA	10.00
SK630	Socket For 4CX600J,JA	66.00
SK636B	Chimney For 4CX600J,JA	34.00
SK640	Socket For 4CX600J,JA	36.00
SK646	Chimney For 4CX600J,JA	71.00
SK700	Socket For 4CX300A,Y,4CX125C,F	225.00
SK711A	Socket For 4CX300A,Y,4CX125C,F	225.00
SK740	Socket For 4CX300A,Y,4CX125C,F	86.00
SK770	Socket For 4CX300A,Y,4CX125C,F	86.00
SK800A	Socket For 4CX1000A,4CX1500B	225.00
SK806	Chimney For 4CX1000A,4CX1500B	40.00
SK810	Socket For 4CX1000A,4CX1500B	225.00
SK900	Socket For 4X500A	300.00
SK906	Chimney For 4X500A	57.00
SK1420	Socket For 5CX3000A	650.00
SK1490	Socket For 4CV8000A	585.00

JOHNSON TUBE SOCKETS AND CHIMNEYS

124-111/SK606	Chimney For 4CX250B,BC,FG,R, 4CX350A,F,FJ	$ 10.00
122-0275-001	Socket For 3-500Z, 4-125A, 250A, 400A, 4-500A, 5-500A	(pair)15.00
124-0113-00	Capacitor Ring	15.00
124-116/SK630A	Socket For 4CX250B,BC,FG,R, /4CX350A,F,FJ	55.00
124-115-2/SK620A	Socket For 4CX250B,BC,FG,R, /4CX350A,F,FJ	55.00
	813 Tube Socket	20.00

TUBE CAPS (Plate)

HR1, 4	$11.00
HR2,3, 6 & 7	13.00
HR5, 8	14.00
HR9	17.00
HR10	20.00

CHIP CAPACITORS

.8pf	10pf	100pf*	430pf
1pf	12pf	110pf	470pf
1.1pf	15pf	120pf	510pf
1.4pf	18pf	130pf	560pf
1.5pf	20pf	150pf	620pf
1.8pf	22pf	160pf	680pf
2.2pf	24pf	180pf	820pf
2.7pf	27pf	200pf	1000pf/.001uf*
3.3pf	33pf	220pf*	1800pf/.0018uf
3.6pf	39pf	240pf	2700pf/.0027uf
3.9pf	47pf	270pf	10,000pf/.01uf
4.7pf	51pf	300pf	12,000pf/.012uf
5.6pf	56pf	330pf	15,000pf/.015uf
6.8pf	68pf	360pf	18,000pf/.018uf
8.2pf	82pf	390pf	

PRICES: 1 to 10 - .99¢ 101 to 1000 .60¢ * IS A SPECIAL PRICE: 10 for $7.50
11 to 50 - .90¢ 1001 & UP .35¢ 100 for $65.00
51 to 100 - .80¢ 1000 for $350.00

WATKINS JOHNSON WJ-V907: Voltage Controlled Microwave Oscillator $110.00

Frequency range 3.6 to 4.2GHz, Power ouput, Min. 10dBm typical, 8dBm Guaranteed. Spurious output suppression Harmonic (nf_0), min. 20dB typical, In-Band Non-Harmonic, min. 60dB typical, Residual FM, pk to pk, Max. 5KHz, pushing factor, Max. 8KHz/V, Pulling figure (1.5:1 VSWR), Max. 60MHz, Tuning voltage range +1 to +15volts, Tuning current, Max. -0.1mA, modulation sensitivity range, Max. 120 to 30MHz/V, Input capacitance, Max. 100pf, Oscillator Bias +15 +-0.05 volts @ 55mA, Max.

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TUBES

TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
2C39/7289	$ 34.00	1182/4600A	$500.00	ML7815AL	$ 60.00
2E26	7.95	4600A	500.00	7843	107.00
2K28	200.00	4624	310.00	7854	130.00
3-500Z	102.00	4657	84.00	ML7855KAL	125.00
3-1000Z/8164	400.00	4662	100.00	7984	14.95
3B28/866A	9.50	4665	500.00	8072	84.00
3CX400U7/8961	255.00	4687	P.O.R.	8106	5.00
3CX1000A7/8283	526.00	5675	42.00	8117A	225.00
3CX3000F1/8239	567.00	5721	250.00	8121	110.00
3CW30000H7	1700.00	5768	125.00	8122	110.00
3X2500A3	473.00	5819	119.00	8134	470.00
3X3000F1	567.00	5836	232.50	8156	12.00
4-65A/8165	69.00	5837	232.50	8233	60.00
4-125A/4D21	79.00	5861	140.00	8236	35.00
4-250A/5D22	98.00	5867A	185.00	8295/PL172	500.00
4-400A/8438	98.00	5868/AX9902	270.00	8458	35.00
4-400B/7527	110.00	5876/A	42.00	8462	130.00
4-400C/6775	110.00	5881/6L6	8.00	8505A	95.00
4-1000A/8166	444.00	5893	60.00	8533W	136.00
4CX250B/7203	54.00	5894/A	54.00	8560/A	75.00
4CX250FG/8621	75.00	5894B/8737	54.00	8560AS	100.00
4CX250K/8245	125.00	5946	395.00	8608	38.00
4CX250R/7580W	90.00	6083/AZ9909	95.00	8624	100.00
4CX300A/8167	170.00	6146/6146A	8.50	8637	70.00
4CX350A/8321	110.00	6146B/8298	10.50	8643	83.00
4CX350F/8322	115.00	6146W/7212	17.95	8647	168.00
4CX350FJ/8904	140.00	6156	110.00	8683	95.00
4CX600J/8809	835.00	6159	13.85	8877	465.00
4CX1000A/8168	242.50*	6159B	23.50	8908	13.00
4CX1000A/8168	485.00	6161	325.00	8950	13.00
4CX1500B/8660	555.00	6280	42.50	8930	137.00
4CX5000A/8170	1100.00	6291	180.00	6L6 Metal	25.00
4CX10000D/8171	1255.00	6293	24.00	6L6GC	5.03
4CX15000A/8281	1500.00	6326	P.O.R.	6CA7/EL34	5.38
4CW800F	710.00	6360/A	5.75	6CL6	3.50
4D32	240.00	6399	540.00	6DJ8	2.50
4E27A/5-125B	240.00	6550A	10.00	6DQ5	6.58
4PR60A	200.00	6883B/8032A/8552	10.00	6GF5	5.85
4PR60B	345.00	6897	160.00	6GJ5A	6.20
4PR65A/8187	175.00	6907	79.00	6GK6	6.00
4PR1000A/8189	590.00	6922/6DJ8	5.00	6HB5	6.00
4X150A/7034	60.00	6939	22.00	6HF5	8.73
4X150D/7609	95.00	7094	250.00	6JG6A	6.28
4X250B	45.00	7117	38.50	6JM6	6.00
4X250F	45.00	7203	P.O.R.	6JN6	6.00
4X500A	412.00	7211	100.00	6JS6C	7.25
5CX1500A	660.00	7213	300.00*	6KN6	5.05
KT88	27.50	7214	300.00*	6KD6	8.25
416B	45.00	7271	135.00	6LF6	7.00
416C	62.50	7289/2C39	34.00	6LQ6 G.E.	7.00
572B/T160L	49.95	7325	P.O.R.	6LQ6/6MJ6 Sylvania	9.00
592/3-200A3	211.00	7360	13.50	6ME6	8.90
807	8.50	7377	85.00	12AT7	3.50
811A	15.00	7408	2.50	12AX7	3.00
812A	29.00	7609	95.00	12BY7	5.00
813	50.00	7735	36.00	12JB6A	6.50

NOTE * = USED TUBE

NOTE P.O.R. = PRICE ON REQUEST

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"FILTERS"

COLLINS Mechanical Filter #526-9724-010 MODEL F455Z32F

455KHZ at 3.2KHz wide. May be other models but equivalent. May be used or new. $15.99

ATLAS Crystal Filters

5.595-2.7/8/LSB, 5.595-2.7/LSB
8 pole 2.7KHz wide Upper sideband. Impedence 800ohms 15pf In/800ohms 0pf out. 19.99

5.595-2.7/8/U, 5.595-2.7/USB
8 pole 2.7Khz wide Upper sideband. Impedence 800ohms 15pf In/800ohms 0pf out. 19.99

5.595-.500/4, 5.595-.500/4/CW
4 pole 500 cycles wide CW. Impedance 800ohms 15pf In/800ohms 0pf out. 19.99

9.0USB/CW
6 pole 2.7KHz wide at 6dB. Impedance 680ohms 7pf In/300ohms 8pf out. CW-1599Hz 19.99

KOKUSAI ELECTRIC CO, Mechanical Filter #MF-455-ZL/ZU-21H

455KHz at Center Frequency of 453.5KC. Carrier Frequency of 455KHz 2.36KC Bandwidth.
Upper sideband. (ZU) 19.99
Lower sideband. (ZL) 19.99

****

CRYSTAL FILTERS

NIKKO	FX-07800C	7.8MHz	$10.00
TEW	FEC-103-2	10.6935MHz	10.00
SDK	SCH-113A	11.2735MHz	10.00
TAMA	TF-31H250	CF 3179.3KHz	19.99
TYCO/CD	001019880	10.7MHz 2pole 15KHz bandwidth	5.00
MOTOROLA	4884863B01	11.7MHz 2pole 15KHz bandwidth	5.00
PTI	5350C	12MHz 2pole 15KHz bandwidth	5.00
PTI	5426C	21.4MHz 2pole 15KHz bandwidth	5.00
PTI	1479	10.7MHz 8pole bandwidth 7.5KHz at 3dB, 5KHz at 6dB	20.00
COMTECH	A10300	45MHz 2pole 15KHz bandwidth	6.00
FRC	ERXF-15700	20.6MHz 36KHz wide	10.00
FILTECH	2131	CF 7.825MHz	10.00

****

CERAMIC FILTERS

AXEL	4F449	12.6KC Bandpass Filter 3dB bandwidth 1.6KHz from 11.8-13.4KHz	10.00
CLEVITE	TO-01A	455KHz+-2KHz bandwidth 4-7% at 3dB	5.00
	TCF4-12D36A	455KHz+-1KHz bandwidth 6dB min 12KHz, 60dB max 36KHz	10.00
MURATA	BFB455B	455KHz	2.50
	BFB455L	455KHz	3.50
	CFM455E	455KHz +-5.5KHz at 3dB , +-8KHz at 6dB , +-16KHz at 50dB	6.65
	CFM455D	455KHz +-7KHz at 3dB , +-10KHz at 6dB , +-20KHz at 50dB	6.65
	CFR455E	455KHz +-5.5KHz at 3dB , +-8KHz at 6dB , +-16KHz at 60dB	8.00
	CFU455B	455KHz +-2KHz bandwidth +-15KHz at 6dB, +-30KHz at 40dB	2.90
	CFU455C	455KHz +-2KHz bandwidth +-12.5KHz at 6dB , +-24KHz at 40dB	2.90
	CFU455G	455KHz +-1KHz bandwidth +-4.5KHz at 6dB , +-10KHz at 40dB	2.90
	CFU455H	455KHz +-1KHz bandwidth +-3KHz at 6dB , +-9KHz at 40dB	2.90
	CFU455I	455KHz +-1KHz bandwidth +-2KHz at 6dB , +-6KHz at 40dB	2.90
	CFW455D	455KHz +-10KHz at 6dB , +-20KHz at 40dB	2.90
	CFW455H	455KHz +-3KHz at 6dB , +-9KHz at 40dB	2.90
	SFB455D	455KHz	2.50
	SFD455D	455KHz +-2KHz , 3dB bandwidth 4.5KHz +-1KHz	5.00
	SFE10.7MA	10.7MHz 280KHz +-50KHz at 3dB , 650KHz at 20dB	2.50
	SFE10.7MS	10,7MHz 230KHz +-50KHz at 3dB , 570KHz at 20dB	2.50
	SFG10.7MA	10.7MHz	10.00
NIPPON	LF-B4/CFU455I	455KHz +-1KHz	2.90
	LF-B6/CFU455H	455KHz +-1KHz	2.90
	LF-B8	455KHz	2.90
	LF-C18	455KHz	10.00
TOKIN	CF455A/BFU455K	455KHz +-2KHz	5.00
MATSUSHIRA	EFC-L455K	455KHz	7.00

****

SPECTRA PHYSICS INC, Model 088 HeNe LASER TUBES

POWER OUTPUT 1.6MW. BEAM DIA. .75MM BEAM DIR. 2.7MR 8KV STARTING VOLTAGE DC
68K OHM 1WATT BALLAST 1000VDC +-100VDC At 3.7MA $59.99

ROTRON MUFFIN FANS Model MARK4/MU2A1

115 VAC 14WATTS 50/60CPS IMPEDENCE PROTECTED-F 88CFM at 50CPS $ 7.99
105CFM at 60CPS

THESE ARE NEW

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HEWLETT PACKARD SIGNAL GENERATORS

606A	50KHz to 65MHz in 6 bands +-1%,Output level adjustable 0.1uV to 3V into 50 ohms.Built-in crystal calibrator.400 -1000Hz modulation.	$ 650.00
606B	Same as above but has frequency control feature to allow operation with HP 8708A Synchronizer.	$1100.00
608C	10MHz to 480MHz,0-1uV-1V into 50 ohms,AM,CW,or pulse modulation, calibrated attenuator.	$ 500.00
608D/ TS510	10MHz to 420MHz, 0.1uV-0.5V into 50 ohms,+-0.5% accuracy, built-in crystal calibrator, AM-CW or pulse output.	$ 375.00
608E	Improved version of popular 608C.Up to 1V output.Improved stability,low residual FM.	$1450.00
6^8F	10MHz to 455MHz in 5 bands +-1% frequency accuracy with built-in crystal calibrator.Can be used with HP 8708A Synchronizer. Output continuously adjustable from .1uV to .5V into 50 ohms.	$1100.00
612A	450-1230MHz ,0.1uV-0.5V into 50 ohms,calibrated output.	$ 750.00
614A	900-2100MHz with many features including calibrated output and all modulation characteristics.	$ 500.00
616A/ TS403	Direct reading and direct control from 1.8 to 4.2GHz. The H.P.616A features +-1.5dB calibrated output accuracy from -3127dBm to -dBm.The output is directly calibrated in microvolts and dBm with continuous monitoring. Simple operation frequency diad accuracy is +-1% and stability exceeds 0.005%-/ C change in ambient temperature. Calibrated attenuator is within +-1.5dB over entire output band. 50 ohm impedance unit has internal pulse modulation with rep rate variable from 40 Hz to 4KHz,variable pulsewidth(1 to 10usec)and variable pulse delay(3 to 300usec).External modulating inputs increas versatility.	$ 375.00
616B	Same as above but later model.	$ 600.00
618B	3.8 to 7.6GHz range,with calibrated output and selection of pulse-FM or square wave modulation.	$ 600.00
618C	Same as above but later model.	$2200.00
620A	7 to 11GHz range,with calibrated output and selection of pulse-FM or square wave modulation.	$ 750.00
620B	Same as above but later model.	$2200.00
626A	10 to 15GHz,10mw output power with calibrated output and pulse-square wave or FM modulation.	$4200.00
8708A	Synchronizer used with 606B,608F.The synchronizer is a phase-lock frequency stabilizer which provides crystal-oscillator frequency stability to 430MHz in the 608F signal generator.Phase locking eliminates microphonics and drift resulting in excellent frequency stability.The 8708A includes a vernier which can tune the reference oscillator over a range of +-0.25% permitting frequency settability to 2 parts in 10 to the seventh.Provides a very stable signal that satisfies many critical applications.	
	(With HP 606B or 608F)	$ 350.00
	(Without)	$ 450.00
EMC-10	ELECTROMETRICS EMC-10 RFI/EMI RECEIVER Low frequency analyzer covering 20Hz to 50KHz frequency range.Extendable to 500 KHz in wideband mode.	$2500.00
NF-105F	Empire Devices Field Intensity Meter. Has NF-105/TA,NF-105/TX,NF-105/T1,NF-105/T2,NF-105/T3. Covers 14KHz to 1000MHz.	$2100.00

ALL EQUIPMENT CARRY A 30 DAY GUARANTEE.

EQUIPMENT IS NOT CALIBRATED.

UNEX LABORATORIES THS-2 FLEXICOM HEADSET.

these headsets come with data to hook up to a ICOM radios and many other equipment.

Perfect for Airplanes , Helicopters , Mobile Radios , or Just the Telephone.

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73 INTERNATIONAL

from page 76

trix printer), I am obviously not a fan of mechanical systems. I was surprised, therefore, to note that 60% of traditionalists plan to keep their mechanized RTTY.

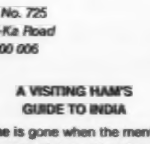
As more and more computers come into amateur-radio shacks, so the desire for higher transmission speeds takes on a more urgent note. After years of watching news agency reports print at 50 baud, the thought of 300 (or even 1200) baud is indeed enticing. A problem with the existing *de facto* amateur data-transmission standard (CUTS or Kansas City) is that it uses harmonically-related tones which will give very poor results in conditions of low signal-to-noise ratio.

BARTG has therefore proposed (for consideration at the IARU region conference in 1984) that existing RTTY standards be used as follows—300 baud, 170-Hz shift; 1200 baud, 850-Hz shift. FSK transmissions will have space on the lower radio frequency and AFSK will use 1275 Hz for space and 1445 Hz (170-Hz shift) or 2125 Hz (850-Hz shift) for mark for 300 baud or 1200 baud, respectively.

Further BARTG proposals for the conference include:

- The adoption of a 10-bit ASCII code using even or indeterminate parity (plus 1 start, 7 data, and 1 stop). (Author's note: Many commercial systems use 11 bits for asynchronous ASCII by adding a second stop bit.)
- The adoption of CCIR 476-1 at 100 baud (the basis of AMTOR) as the international amateur standard for an error-correcting code.
- Standard amateur RTTY speeds of 50, 75, and 100 baud (note the dropping of 45.45).
- Dropping the requirement that amateur RTTY stations regularly transmit voice or CW identifications when using CCITT alphabet no. 2 (Baudot).
- The adoption for amateur mailbox operations of the protocols used for Viewdata (Videotex).

I find the last proposal rather odd and think it is almost a backward step! Viewdata does not use error-correction and is asymmetric (uses different speeds in the forward/return directions).



INDIA

R. Subha
Post Box No. 725
3 Thiru-Vi-Ka Road
Madras 600 006
India

A VISITING HAM'S GUIDE TO INDIA

The time is gone when the mention of India conjures up visions of snake charmers, elephants, and maharajas. All these are there, but there is much more of interest to the visitor—ham radio, for instance.

Those who believe that India is a backward country are in for a jolt. Your first exposure to India will, of course, be the airport (or the seaport, if you are the M/M type). Modern communications and facilities at these entry points convince the visitor that he has come to yet another advanced country. What, then, is this talk about underdeveloped and developing countries? That is for consumption by the World Bank and other UN organizations. Yes, we do have a lower *per capita* income, but everything is cheap in the same proportion. In brief, you can live in India on as many rupees as you would need dollars living in the US for a comparable standard of living. India builds its own nuclear power plants and launches its own satellites on its own rockets—a little late, but with the technological advantages of the state of the art. Soon, Indian hams will be using a satellite built by them and launched for them by the Indian Space Research Organization. It will probably be called the Indamsat—such an appropriate acronym!

So, you probably landed in Bombay on a Pan Am flight. Bombay has over 200 callsigns and most of them are members of a club called the Radio and Electronics Society of India. One of the dream shacks is that of Capt. D. Dasan VU2AID, a senior manager in Air India who also holds the Australian call VK6IK. Most shacks in Bombay have Icom or Kenwood equipment, thanks to VU2RX (who represents these two companies). Quite a few of them sport quads or tribander beams. Activity is mostly on the 14-, 21-, and 28-MHz bands. 2 meters is just getting started, but it will take a repeater to really turn this band on. It won't be long before one is installed. The calling frequencies are 145.0 and 145.5 MHz all over the country.

There are more than 50 callsigns in Delhi, but quite a few are inactive. The active calls were Bernd VU2LQA from the German embassy, Aoki VU2JPN from the Japanese embassy (both of whom have left India), and brothers Rakesh VU2RAK and Rahul VU2YK, who are still in Delhi. Brad VU2USE from the American embassy was active, but he has now been posted to some other country.

Madras has its share of active hams, including Chauhan VU2MV, President of the Federation of Amateur Radio Societies of India (FARSI), who uses a Ten-Tec Delta. Equipment in the Madras shacks is mostly Heath, Ten-Tec, and Yaesu. In this city of 4 million, you will find the pace of life brisk but not breakneck. Hams here will find time for a friendly chat with you, even if you arrive unannounced. Avoid morning visits if you can, except on holidays. Life begins early—around 5:00 in the morning—and most hams are at work (known in India as morning QTH) by 8:30. Most of them can receive visitors at their place of work and in any case can be got at on the telephone. The 2-meter net meets on 145.5 at 0800 and 2000 hours daily.

Bangalore, promoted as the Garden City of India, is about the same as Madras, except that work for many begins at 7:00 in the morning. The Bangalore boys are back home by 5 in the evening even after commuting tens of miles. Many of these are not available by telephone, but put your 2-meter rig on scan and you may meet many of them.

If you are planning a short visit of a few weeks to India, you will probably not have enough time to obtain a reciprocal license. You can, however, operate from an Indian shack with the permission of the OM, and you can save the trouble of bringing along your shack. However, the path towards W opens up at an inconvenient time for working hams (around 1100Z), so unless you plan to operate from a pensioner's shack, it is likely that you will get to everywhere except your homeland!

N. L. Krishnan of Bharat Electronics.

In the event that you are planning to have a home in India for a few months, you can apply for a license about the same time that you apply for a visa. Your application should be addressed to the Wireless Adviser to the Government of India, Dept. of Communications, WPC Wing, Sardar Patel Bhavan, Sardar Sq., Parliament Street, New Delhi 110 001. The application form can be obtained from that office or more promptly by writing The Federation of Amateur Radio Societies of India, 3 Thiru-Vi-Ka Road, Post Box No. 725, Madras 600 006, India (include 3 IRCs to cover postage). A self-addressed envelope will further speed up action; the forms will be posted the same day as your letter is received in India. Send 10 more IRCs if you want a copy of the Indian *Callbook* (which also contains telephone numbers).

You need not send money with your application, but do send a copy to the Federation. When you get your visa, write a letter to The Wireless Adviser to the Government of India, confirming that you got it. Send a copy to the Federation. You will normally get the license by the time you arrive in India, although much depends upon the workload in the licensing department at the time of your application.

The power allowed in India is 150 Watts rf output to antenna, which covers any barefoot transceiver other than the KWM2. Unless you are holding a Novice license, you will be allowed the use of the following bands: 7.000–7.100 MHz; 14.000–14.350 MHz; 21.000–21.450 MHz; 28.000–29.700 MHz; and 144–146 MHz.

The Indian government is extremely friendly towards amateur radio and foreign amateurs. If there is a delay in response to your application, interpret it generously as resulting from excessive workload. Once in a while the government may turn down your application. The reason will probably be the same as when the US embassy turns down an Indian application for a visa to visit the US. You cannot fight Capitol Hill, so resign yourself to operating from an Indian shack if your visa is not also refused. In the latter event, the problem neatly solves itself!

Now that you have a fairly good idea of what to do, plan your next vacation in India. Air India is a good airline and will be pleased to be of service if you choose to fly with them. You might even run into Capt. D. Dasan VU2AID, their operations manager, Vice-President of FARSI, on one of the jumbos or at one of the airports.

*****

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The government of India has authorized the following operating frequencies for VU2 hams. Certain frequencies as indicated (*) are shared with other services: 3500–3540* kHz; 3890–3900 kHz; 7000–7100 kHz; 1400–14350 kHz; 18068–18168* kHz; 21000–21450 kHz; 24890–24990* kHz; 28000–29700 kHz; and 144–146 MHz.

The type of emission allowed to grade II operators in the band up to 24.900 MHz is A1 only with 50 W maximum dc input power. On 28–29.7 MHz, A1, A3, A3A, A3J, and A3H are permitted. On 144–146 MHz, A3, A3A, A3J, and F3 are permitted with a power limit of 10 W.

For grade I license holders, A1, A3, F3, A3A, A3J, A3H, F1, F2, F3, and A5 are permitted on the HF band; A2 is permitted, in addition to the above, for the VHF band. Power is limited to 150 W in the HF band and 25 W in the VHF band for terrestrial and satellite work.

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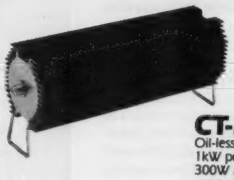

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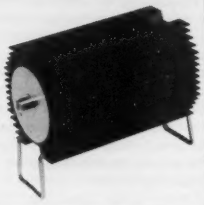

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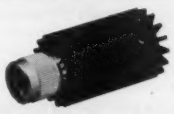

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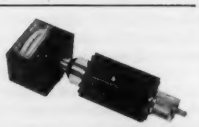

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station, A1, A3, A3A, A3J, A3H, F1, F2, F3, and A5 operations are permitted in the HF bands (with power limited to 150 W). Also, A1, A2, A3, A3A, A3J, F1, F2, F3, F4, A3H, A4, and A5 operations (with a power limit of 50 W for terrestrial and 100 W for satellite-working) are permitted.

VU2BEL

The Managing Director of Bharat Electronics Limited (BEL), Mr. N. L. Krishnan, has promised to help their club station (VU2BEL) with all facilities and equipment. There are more than 40 hams on the roll of the establishment. In addition to the club building, the establishment has provided their communications equipment, test equipment, antenna systems, etc. Now it is left to the inclination and interest of the hams to exploit and utilize the facilities openly offered by the Managing Director. He has whole-heartedly said that he is willing to help hams with projects for the design and development of new amateur equipment, especially ham gear which can be produced and marketed so that the national market for ham equipment can evolve.

The photograph shows the Managing Director operating one of the transceivers manufactured by BEL and given to the VU2BEL club station.

ISRAEL

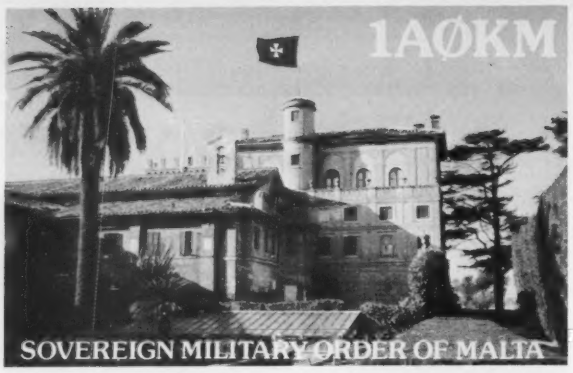
Ron Gang 4Z4MK
Kibbutz Urim
Negev Mobile Post Office 85530
Israel

I hope that from the last few columns you haven't gotten the impression that the only amateur pioneering work being done here is in the VHF/UHF frontier. Yes, the lower end of the amateur spectrum is a new territory just beginning to be mapped here. You see, when in 1979 the World Administrative Radio Conference decided to expand the ham bands, the groundwork was laid for 160 meters to be opened up in this part of the world. So, for the hardy souls who brave the static-crash-torn reaches of the Top Band, we can now see what this band has to offer.

In the forefront of the pioneering effort here is Riki 4X4NJ of Gan Yavne on the Mediterranean coast about fifty kilometers south of Tel-Aviv. Riki's endeavors on 160 go back to pre-WARC years when, for the CQ Worldwide test in October, 1973, a special license was granted to set up a station. A full-size sloping dipole was hung from the top of the Four Seasons Hotel in Natanya, on a cliff overlooking the Mediterranean, and a Swan 160-meter transceiver on loan from VE3MR provided the means of exciting this effective antenna. From here on, Riki continued to experiment with this band from his own QTH, applying for special permission whenever an international contest would come up.

In October, 1982, along with 30, 17, and 12 meters, 160 became available to the Israeli radio amateur. 1810–1850 kHz may be used on a primary basis by Class A amateurs running a maximum of 100 Watts input and Class B operators with 10 Watts. 1850–200 kHz may be used by A licensees only on a secondary-non-interfering basis with 10 Watts input.

4X4NJ has since then worked all continents and run up the all-time record for Asia in the CQ WW contest. The credit must go to hard work, perseverance, and sparing no efforts on a good antenna system.



The 1AØKM pictorial QSL card, showing the SMOM location, an ancient villa near the Tevere river which has been recognized as a national monument. For that reason, the tribander beam shown on the terrace (just right of the pine tree) had to be dismantled. A tilting-down five-bander vertical is now planned for the same terrace.

Riki began by loading the insulated guy wires of his 65-foot-high tower, resembling an inverted L sloping towards North America. Since then, the sky-wires have become more sophisticated, transmitting into a 100-foot wire hung from the top of the tower which is base loaded through a silver-plated coil. Sixteen 80-meter radials plus five quarter-wavelength 160-meter radials which are strung out temporarily over adjoining fields for contest weekends and assorted buried pipes comprise an effective ground system.

Receiving was at first the real problem: It was painstakingly difficult to dredge the far-off stations calling 4X4NJ out of the atmospheric noise. Thus, Riki switched between four different receiving antennas: the transmitting antenna plus attenuators, a horizontally-polarized omnidirectional dipole twelve feet up, a two-element vertical phased array composed of two twenty-foot elements with a rotatable pattern and remote transistor preamps, and an 80-foot-long non-terminated Beverage wire bi-directional to Europe and North America on one end and VK-ZL on the other. The Beverage, which Riki added last season, far outshone the previous receiving antennas, finding the North American stations, unreadable on the other antennas, were Q5 on this. This receiving antenna, added last winter, made it possible to hear better than Riki could be heard, so he decided that the next step in which to go was that of better transmitting effectiveness.

In early October, I got hold of Riki on the Tel Aviv repeater, and he told me of what appears to be his latest breakthrough. He recently completed a phased transmitting array with a very low angle of radiation and a rotary switch for selecting antenna direction. Construction details are being withheld until this antenna has been thoroughly tested out. Riki says that it appears to have a 15-to-20-dB front-to-back ratio and a forward gain of 6 to 10 dB. On receiving, it competes with the Beverage, and in certain instances actually outperforms it! Both G3BDQ and DJ8WL reported that he was coming in like a local, with a greatly improved signal, so Riki is expecting big things out of this antenna.

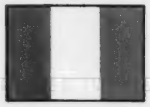
On the equipment end (notice that we've left this for last, as on 160, the antenna is what really makes the difference), Riki is using the Drake C-line, with a combination of I-f and af filtering to squeeze the weak signals out of the noise. At this time, 4X4NJ has worked on Top Band 72 countries (53 confirmed), 25 US states, and all continents.

We wish Riki best success on 160 this season, and hopefully some of you will have already made contact with him. There are other Israeli stations on 160 meters, but by far 4X4NJ is the most serious of all!

I would like to conclude this month by thanking all those who have taken the time to respond to this column, either by letter or on the air. It has been heartening for me to know that so many people are interested in what's happening in this country outside of the tense headline news. This underlines the human aspect of amateur radio that makes possible people-to-people contacts, bypassing international boundaries and tensions.

Until next month, Shalom (peace) and 73.

The 1AØKM crew. From left, standing: IØMGM, IØJX, IØAMU, IØMXM. IØIJ is sitting at the mike. The atmosphere of the very exclusive ham shack is enhanced by ancient and valuable pictures on the walls.



ITALY

Giancarlo Martelli IØXXR
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00162 Roma
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Mario Ambrosi I2MQP
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1AØKM—THE SOVEREIGN MILITARY ORDER OF MALTA HAM STATION

One of the most requested countries in the DXCC fan's world is the Sovereign Order of Malta, prefix 1AØ. This political entity, founded in 1099, recognized by Pope Pascal II in 1310, and known as SMOM—Sovrano Militare Ordine di Malta—is fully independent from the Italian state, and under the provisions of international law, it maintains diplomatic relations with many countries and international organizations. The main activity of the tiny political and territorial entity, which is located in a beautiful spot of Rome near the Tevere River, is concerned with worldwide assistance in the sanitary and social fields.

The 1AØKM station was activated in November, 1980, when the Knights of Malta asked some amateurs to give their assistance in setting up radio contacts with their field hospitals located in the territory hit by the tremendous earthquake in Irpinia, South Italy. Just following that event, 1AØKM operated for some months, until January, 1981, raising savage pileups whenever it appeared on the bands. During that period, the station made about 8,000 QSOs. The DX Advisory Committee of the ARRL, after a complete survey of the documents submitted by SMOM through the station operators, recognized the independent political status of the territory governed by the Knights of Malta and added the 1AØ prefix to the DXCC list, giving credit to the 1AØKM cards starting from its earliest operations. The amateurs who started up the station and the new country, and who at present are the exclusive operators allowed to carry out ham-radio activity there, are Al IØAMU, Tony IØIJ, Tony IØJX, Mario IØMGM, and Mario IØMXM.

Due to the room shortage in the ancient villa which houses SMOM, the 1AØKM station does not yet have a fixed setup, and the rigs, as well as the antennas, are being taken inside and assembled whenever the station must operate; this is neither practical nor fast.

A tribander beam antenna which was mounted on the building roof had to be disassembled for esthetic reasons, since the villa is recognized as an antique and a valuable monument.

At the time of this writing, the 1AØKM crew is trying to get a corner to set up a permanent shack and a permanent antenna. The already-mentioned willing boys taxed themselves and bought a Yaesu FT-901DM transceiver, a Henry R2DK Classic

amplifier, and a five-band 18AVT ground plane. They plan to put the antenna on the building terrace, with provisions to tilt it down on the floor when not in operation. This stable arrangement will allow the station crew to put the 1A0 sigs on the air more frequently, possibly entering some international contests as well.

The official QSL manager is Mario I0MGM, but due to the very heavy task involved with such a management, the cards for contacts made with the other operators (I0IJ, I0JX, I0AMU, and I0MXM) may be sent directly to these boys, who will manage their own QSLs: Antonio Privitera I0IJ, Via Ceresio, 34, 00199 Rome; Antonio Vernucci I0JX, Via G. C. Abba, 8, 00141 Rome; Mario Gallavotti I0MGM, Via Cassia, 929, 00189 Rome; Alfonso Porretta I0AMU, L.go S.Pio V, 16, 00165 Roma; and Mario Monaco I0MXM, Via R. Paolucci, 27/13, 00152 Rome.

HAM RADIO IN ITALY BEFORE WWII

It may be that the old-timers who started their activity before WWII are interested in knowing what amateur radio was like in Italy during the Fascist period. Italy had its own pioneers, like Adriano Ducati 1ACD, Giulio Salom 1MT, and others who broke the shortwave DX frontiers, establishing some world records in the roaring old times, around 1924–1925. They had government provisional permission then, as no laws or rules on amateur-radio activity had been issued in our country at that time. These laws or rules were never issued by the Fascist government, excluding one point of the Italian Postal Code where it was stated that "nobody shall exercise a transmitting radio station without the Post and Telegraph Ministry permission." Theoretically, ham radio was not forbidden, but on the other hand, the permission was not granted either. The reason for this was that the Fascists did not see with much pleasure every form of private contact between the Italian citizens and foreign democratic countries.

Naturally, radio had many fans in Italy, mostly devoted to home-brewing. There were three or four consumer magazines devoted to these fans, publishing descriptions, schematics, and advice on how to build BC radios, SW radios, and even amateur transmitters. There were also many good technicians, many of them very young, who home-brewed good SW receivers and listened to international BC stations and to foreign amateurs.

During that period, Ing. Ernesto Montu, an electronics engineer and university teacher who was famous in Italy for his *Radiotecnique Manual*, and who also had been one of the ham-radio pioneers many years before, founded the ARI, the association which still officially represents amateur radio in our country. At the same time, some amateur stations appeared on the bands in a clandestine way, with self-assigned callsigns. They did not communicate their names or QTHs, and they operated undisturbed. Their number started to grow, and in the meantime, Ing. Montu started a very small (but very dangerous in those times) QSL bureau in his own home, which also housed the ARI headquarters and a new magazine, *Radio Giornale*, the official journal of the association.

Year after year, the number of Italian hams increased. They tried to have a clean and purely technical kind of operation, in order not to raise any suspicion as to their intentions. The political police and the postal police played a very fair game and were highly tolerant as they apparently seemed to ignore that kind of activity.

I was almost a kid then and was deeply involved with radio, home-brewing receivers—at first simple crystal types, then regenerative sets with two or more tubes. When I first received shortwave, I was fascinated by the code transmissions and learned it in a hurry; then when I started to listen to the amateurs, I got really excited. I tried to get some information on how to get started, but the answers I got were vague. Some operators told me that they were Fascists, and that only Fascists could operate radio stations. Others warned me not to get involved in such a dangerous activity. I was 17 when I decided that I had to get on the air. My poor pocket (I was a student) permitted me to buy a '45 tube and an '80 rectifier, a supply transformer, and some other parts, all secondhand, and I started my activity with the 45' self-oscillating in a Hartley circuit and a Windom antenna.

I made a lot of DX contacts with that makeshift rig and got my WAC, which lived in my heart since I could not get the award from the ARRL! Although I did not declare my QTH and my name on the air, I found that some form of hidden intelligence, word after word, indication after indication, could be carried out in order to get in touch with other Italian fellows. That system worked, and I joined other friends and attended the annual meeting, a very clandestine one in Milano, where I knew Mr. Montu and had the chance to receive some QSL cards.

I had to rely only on that simple QRP rig and on a three-tube regenerative receiver, as my pocketbook did not permit much more. Many Italian hams were in possession of sophisticated transmitters, like crystal-controlled MOPAs with transmitting tubes in the power amplifier. Many of these tubes and components, like 807s and 813s, were coming into Italy through bootleggers from Switzerland. In Italy, we also had a very good commercially-produced receiver, with a six-band drum coil switching system, low-loss materials in the front end, S-meter, and optional bfo. It fit into a sumptuous mahogany cabinet like a BC receiver, but in reality, it was a real communication receiver. It was put out by IMCA, a firm owned by an underground Italian ham. That beautiful receiver was in many Italian shacks during the latter half of the thirties.

One day, I got an answer to a CQ from a very powerful station, presumably local, which gave a ham callsign and spoke perfect ham language. The operator, to my surprise, gave me an address in the same city where I lived—Bologna—and invited me to pay him a visit. His open style was very unusual in our community, but his invitation and his voice sounded so friendly that I decided to go. I turned pale when on the door I read: "Voluntary Militie for the National Security—Radio Center." I decided to turn back when a gentleman who was standing near the door asked me if I was I1PL. He said, "I imagined your surprise and your fear, so I was waiting just to reassure you, Old Man." He cordially invited me inside.

Wow! For the first time in my life I saw an RCA AR88 and an RME 69! All around were racks filled with radio gear. "Boy, what is that strange key with two black paddles? What does 'Vibroplex' mean?" I felt myself getting faint when I saw some shelves filled with *QSTs*, ARRL handbooks, and bunches of QSLs from everywhere in the world. "What kind of QSL bureau are you using?" I asked him. "Direct mail" was the answer. My surprise was endless, as there was a tight censorship of mail to and from abroad.

I visited another room where I saw several AR88s and some operators typewriting. Nobody explained to me what they were watching. My new friend was a lieutenant colonel of the Fascist Militia, a military organization composed of members of the Fascist Party which cooperated with the regular army and supported the Fascist idea within Italian society. I visited my new friend very often and introduced him to other amateurs of Bologna.

Going back in my memory to these old days, I now realize that the funny situation which had seen outlaw radio amateurs becoming friends of the people who denied licenses and transmitting permission was the mirror of Italian society in the late thirties when the Fascist dictatorship became more of a formality than a reality in everyday life, due to the humanitarian philosophy of the Italian people.

Three years later, when the tragedy of WWII was approaching and the German Army invaded Belgium and Holland, the European radio amateurs were silent, since the administrations had revoked their licenses. Italian hams were still operating, mainly with hams on other continents. One evening, the postal police, together with the political police, paid a visit to Italian ham shacks all over the Italian territory. I must say that they "paid a visit," since when they came to my home they showed extremely good manners. They had a perquisition order, but they asked kindly for permission to take a look at my shack. I was alone at home, as my mother was out, and tried to deny them entrance. They reassured me that there was nothing to worry about, but that they had to confiscate the I1PL station. They took away the rig, the key, the log, and the QSLs. My mother, when she came back, found me sitting on the outdoor step with tears in my eyes.

I ran to my friend the morning after. "Don't worry," he said. "Let the waters settle for a few days and you will have your rig back, but you have to promise that you and your friends will disassemble everything. There will be no more ham radio." A few days later, I was invited to the office of the political police, where I learned that we had been monitored for a very long time. They said that since I carried out only experimental work, I had to pay only the minimum amount of a fine, due to the infringement of the Postal Code: "Nobody shall exercise a transmitting radio station without . . .", etc. A few days later, I got my gear back and disassembled everything.

That was amateur radio before WWII in Italy.

LIMITED ACTIVITY ON 3.5 MHZ

At present and in the near future, until the Italian administration makes up its mind on issuing new rules, it will be practically impossible to work Italian stations on the usual CW, RTTY, and SSB DX subbands recommended by the IARU.

The story starts long ago in 1968 when the last Italian law ruling radio-amateur activity was issued. On that occasion, the Italian administration gave a singular interpretation to the concept of "sharing" the 3.5-MHz band between the Radioamateur Service and other fixed and mobile services. Since amateurs had a secondary status according to WARC statements at that time, they obtained in Italy only the following thin frequency slices: 3.613–3.627 and 3.647–3.667. The rest of the band was assigned to the other services.

Many years passed during which that limiting rule was slowly forgotten. During this long period, amateurs spread out from their narrow subbands and joined their foreign fellows on the whole band. After some years, Italian hams believed that the administration had issued new rules. The administration itself did not care much about this illegal operation, and that reinforced the conviction that everything was OK. I, like many others, never suspected that anything was wrong. In many instances, the ARI official magazine, *Radio Rivista*, published the amateur band plan for Italy, with the whole 3.5-MHz band assigned to amateurs according to the WARC frequency allocations, forgetting the principle that our administration had the right to forbid some frequencies to some services.

Suddenly, last spring, somebody inside these offices remembered the law. A tight monitoring started, and amateurs found outside legal subbands were warned, and some were fined. At the same time, another offensive started: Administration officers visited many ham shacks and fined all those who were found in possession of linear amplifiers, as the maximum legal power in Italy is 300 Watts input. Other minor discrepancies, like inaccurate logging, were verified and prosecuted, and some action was taken against amateurs working 144 MHz mobile from their cars. In fact, in Italy, any amateur mobile operation is forbidden, except for CBers who are authorized to carry radios in their cars.

From this perspective, other clouds could appear on the Italian amateur's horizon. The above-mentioned law does not take into consideration any unattended station outside the legal residence of the licensee: For that, all the VHF and UHF repeaters must be considered illegal and could be dismantled by administration officers. The same thing could be said about the SSB transmission mode: The old 1968 law authorizes only CW, AM, RTTY, and FM above 144 MHz; no further official act authorizing SSB has come since then.

Until today, our administration has closed both eyes; she could suddenly wake up, like she did about the 3.5-MHz band. We strongly hope that these archaic and out-of-date rules may be modified as soon as possible. But as a matter of fact, at present, Italian hams are at least out of the game as far as any 5-band activity is concerned, like contests, awards, etc.

Italian amateurs are still in shock after the withdrawal of the 3.5-MHz band. There are big discussions on the air and in the clubs. The ARI—Associazione Radioamatori Italiani—is accused of not having supported in due time the cause of Italian amateurs on that occasion. In fact, the ARI was absent when the Italian administration started its battle against amateurs. In addition, the ARI failed to warn amateurs about what was happening, so many of them continued to operate outside the permitted slices and were monitored and punished.

Italy is a very beautiful country. It is also a very contradictory one, due to its very young democracy and the problems raised by very fast growth. On one side, there is probably an excess of freedom due to a widely acclaimed liberalism—a clear reaction to the Fascist period. On the other side, most of the bureaucracy suffers from an old-fashioned paternalism to which they abdicate when in the counterpart they find power.

In the telecommunications field, the excess of freedom, unchained by a sentence of the Constitutional Court ("Everybody has the right, by any means, to express his thought"), led to an uncontrolled and abnormal growth of private TV and FM BC stations, operating unlicensed and unpermitted, with no technical control—a real jungle of interference with spurious radiation jamming other services, mainly the

aeronautical ones. The whole situation is absolutely inexpugnable due to the amount of political and commercial interests lying under it. The administration is also faced by other big problems, like the continuous increase of pirate stations. These stations work with amateur transceivers, often using linears and beams, and have invaded many frequencies allocated to the aeronautical mobile services, like 45 meters and segments of bands near 80 meters. An inestimable number of hand-held transceivers (which in Italy are sold with the same ease as a cigarette box) carry illegal private VHF and UHF communications. Due to the power underlying the TV and BC stations and the practical impossibility of locating thousands of illegal stations, the administration had to raise its hands. On the other hand, the administration, incapable of controlling the described mess and overloaded by the problems caused by the fast growth of the communications systems in our country, has a fair chance at repressing the amateurs who pose them further problems, since they are a weak and not a politically supported community.

At present, many Italian groups understand that their problems cannot be solved through traditional negotiation with the administration. They need a different platform. Maybe in the near future they will look for the support of the national media: TV, newspapers, and magazines. It may happen also that they decide to ask for support from fellow amateurs around the world and from ham magazines and foreign ham associations. We regret to inform the hams who read "*73* International" around the world that, for the moment, Italian amateurs are cut out from the international path on the 3.5-MHz band and must disappear from the friendly competitions based on five-band communications. We do hope to be back with you very soon.

de I0XXR

SENATOR COSSIGA

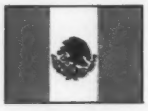
At the end of last July, a telegram was received at the editorial office of the Italian League. The telegram was sent from the Senate—more specifically, from the secretary of the president of the Senate. The telegram said that the president required another copy of the July issue of the national radio magazine, since his copy was probably lost in the mail. It was with great pleasure that a second copy was sent to Francesco Cossiga I0FCG, president of the Senate, the second highest dignitary of the state.

I0FCG has been active since 1973 but hasn't had too much time to devote to radio, and in particular, to DXing—his favorite aspect of the hobby. He has been helped by the DXers of the Rome area with info and QSL routes. During a recent interview with one weekly magazine, he said: "I am a radio amateur and I am sorry not to have too much time to dedicate to it. In any case, during the weekends and holidays that I spend in Sardinia where I come from, I like to chat with friends and contact Alaska, the USA, and New Zealand." Senator Cossiga was born 55 years ago, and after a few years of teaching at Sassari University, he joined the Christian Democrats and won a seat in the House of Parliament in 1958. He has served in various positions in the government and has also been Prime Minister.

NEW DX RECORDS

New records from I0SYN were established during July. A DXpedition sponsored by the Italian DX Blue Team took place during the end of June and the beginning of July. The trip started on June 29 from Perugia, in the center of Italy. The destination was the north of Africa. The group consisted of three Italians: I0SNY, I0KBL, and I0RSC, plus EA5RK. Ceuta, EA9, was reached by car on July 2 after a trip of 3000 kilometers. On July 5, the first record was made with a contact on 1296 MHz with I8TUS/8, for a distance of 1914 kilometers. After giving new ones on 144 and 432 to all Europe, the group started working on 10 GHz, and on July 8, several contacts of more than 1500 kilometers were made. The record contact was 1663 kilometers, with I0YLI/IE9. Next year the group will try again to activate other countries on various frequencies and to break some records.

de I2MQP



MEXICO

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OPERATING IN MEXICO

I have received quite a few letters from foreign colleagues with regards to operating within Mexico while on vacation. No doubt the following information will be useful to many who may have wondered this as well.

Can You Operate In Mexico?

Sure you can! However, just as in all lands, papers are required. And where there are papers, paperwork is involved. Mexico is not the exception. Some call it "red tape." It all depends on how you look at it. This brings to mind an expression that my mother often helped me to appreciate: "What's worth getting is worth waiting for!" It has come in handy and helped me keep a proper perspective of things in life.

What Do You Need To Do?

Well, there are different factors involved. First of all, this depends on whether your country and Mexico have a bilateral or reciprocal agreement or not. The United States does *not*. But if your country does, then you can write to Mexico for an application at the following address: Secretaria de Communicaciones y Transportes, Subdireccion de Operacion de Sistemas Radioelectricos, Depto. de Normas y Reglamentos, Mexico 12, D.F.

The application will state what present requirements are in your case. This, of course, all depends on what details are covered in the reciprocal agreement between your country and Mexico. A photocopy of your present ham license will definitely be asked for upon submitting your application. All foreign visitors will be given a license not exceeding one year from the date it was issued and not longer than the expiration date on your visa. If your home license expires even earlier, don't expect to receive a permit to operate in Mexico for a longer term than what you were issued in your homeland.

No Reciprocal Agreement, You Say?

There still exists the possibility of your getting a limited ham license here, so don't fret. The Mexican FCC (Secretaria de Communicaciones y Transportes—SCT) will establish the requirements that should be satisfied in addition to those requirements that are already set for national amateurs-to-be. The tourist receives a visa for no more than six months, so his license could not be issued for more than that amount of time. The immigrant has to renew his visa (FM-2) each year for five years, so he can be issued a renewed license each year upon presenting a photocopy of his renewed immigration papers.

In either case, if your country does not have a reciprocal agreement with Mexico, then three tests are to be taken.

1) *Morse code*. If you apply for a first-class license, you will be tested at 13 words per minute, second-class applicants will be tested at 10 words per minute, and the beginners will be tested at 5 words per minute. The restricted license (good for one year and not renewable) does not require the code test.

2) *Theory*. This includes electricity, magnetism, and radio communication. Yes, you guessed it! All in Spanish and in your own words! What better incentive could you have for brushing up on your Spanish, besides coming to Mexico?!

3) *Regulations*. You could compare this to a written driver's test. You'll have to know the laws and regulations of the airwaves here in Mexico, just as in any country.

Whether your country has a reciprocal agreement with Mexico or not, you will be required to send in with your application a letter of responsibility, where a national amateur (one who has the same or higher grade license than what you are applying for) states that he will become responsible for you. Many of our *73* readers have already established long-term friendships with different experienced Mexican amateurs over the years and perhaps even had an "eyeball" or two together. So that should not present a problem for you.

Study Material for the Mexican Ticket?

Why don't you write to Pablo A. Mooser M. XE1SR, Av. Schiller #329, Mexico 5, D.F., and get his book: *Guia de Estudios para la Licencia de Radioaficionado* (*Study Guide for the Ham Radio Amateur License*) in Spanish and study up right away! He can also recommend to you some other real fine publications available in Spanish as well, being President of the Amateur Radio League here in Mexico.

Which Class License Do You Want?

Well, then again, that only depends on your personal skills and know-how. Class I and Class II are similar (the only difference being that you can transmit with 1 kW with the Class I license in certain areas and with 250 Watts with the Class II license in certain areas. This is all explained in detail in the above-recommended book and in Mexico's official regulations.

After applying for your license, the Mexican government will then advise you where you should go to take your tests; a few months will be given as a margin. So it would be best for you to apply as far in advance as possible for these tests if your country has no bilateral agreement with Mexico.

Since Mexico borders with the United States, I know that many amateurs from the US visit this country frequently and some may have assumed that there is no way to operate here in Mexico. Nevertheless, my idea here has been to help you realize that you *can* operate as a legal amateur here in Mexico upon fulfilling the proper requirements, even though there is no reciprocal agreement between the US and Mexico. A Mexican amateur cannot get his US license either, unless he fulfills requirements asked by the FCC. And when you think of it, isn't this part of amateur radio? Don't forget that "what's worth getting is worth waiting for!" And thanks again for your many fine letters!

LIBERIA

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Did you ever hear of a *fixed-frequency* amateur net?

Anything can happen in Liberia! We are setting up a fixed-frequency net in the forty-meter band at 7.060 MHz. It is not limited to fixed-frequency radios and it is not limited to stations in Liberia. Actually, the net is in operation at the present time and DX stations, with or without traffic, are welcome to check in. It meets every Sunday morning at zero eight hundred zulu and on other days at zero seven hundred zulu.

Then why all this talk about the fixed frequency?

Well, the Liberia Radio Amateur Association is receiving some two dozen fixed-frequency radios. They are Heathkits and will be converted and crystalled for 7.060 MHz. They will remain Association property and will be rented out for five dollars a year (or less if necessary).

Our Novice-class operators are permitted phone at 7.060 MHz so that they can participate in the net activities. This is important for their encouragement and at the same time it makes our net communication system more effective. This is a very important factor for us here in Liberia where phones and postal service either do not exist or are not dependable. Novices (and in some cases, Generals) cannot afford to buy amateur-radio equipment, so these fixed-frequency radios are going to fill a real need.

The 7.060-MHz frequency is a kind of "get-together frequency" for Liberia and the countries within hearing distance, so our young operators should have ample opportunity to "get out." At the same time, they can talk to each other and they can practice code, on the air, communicating with each other by code. We are excited about this little venture.

The fixed-frequency net is not needed in many other countries, but for us it holds real promise.

THE NETHERLANDS

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RADIO-AMATEUR EXAMS

Twice a year, spring and fall, the Dutch amateur-radio exams are held. All persons who want to get a D license (145 MHz, no code) or upgrade to C class (145 and higher, no code) have to pass this exam.

The exam for the Dutch novice D li-

cense consists of 40 multiple-choice questions about transmitters, receivers, antennas, filters, radio regulations, and license conditions. Three answers are given for each question; you must have at least 29 correct answers to pass this exam with good results.

For the C license, you have to fill in 50 questions and you have the choice of four answers to each question, but you must have 35 answers correct to get a C license.

For the D exam, you have 75 minutes to complete all the questions. For the C exam, you have 30 minutes more time to finish.

The exam is held in a large hall normally used as an exhibition hall. Hundreds of tables and chairs are placed in this enormous hall, with space enough between each table so that it is impossible to look at your neighbor's exam papers.

The exam questions are bundled in a small 15-page booklet. The answers to the questions must be written down on a computer form, so that the forms can be calculated by a computer.

The Dutch amateur-radio exams are not free. The cost is 50 Dutch guilders and must be paid in advance to the account of the Dutch PTT.

After passing the C exam, you can upgrade to the A status (all bands, all modes). For this A status, you must pass a code exam of 12 words a minute.

The results of the exams are mailed to each person who takes the exam. It takes three weeks before the results are mailed. In the meantime, however, there is another way to know the results.

After the exams, National Dutch Amateur Radio Station PA0AA has a special broadcast about the exam results. The Dutch television also publishes the results on the "Dutch Teletekst System."

In 1982, a total of 1607 candidates came to the D exam. 2429 persons took the C exam. So it is plain to see that the interest in amateur radio is very much alive in Holland. Most of this interest is due to the code-free exam of the C and D licenses, but most of the amateurs try to master the code after some years working on VHF and UHF.

If you pass a Dutch amateur-radio exam with good results, you have to sign a paper, a kind of contract, which states that you agree with the license conditions and that you'll agree with rules to be taken by the authorities in the future. So you are agreeing with rules that you do not even know. Well, isn't that a bit strange?

On the day of the exam, the Dutch Radio Control Service has a very busy job. The reason for this is that some amateurs take their radio receivers with them into the exam building so they can receive the answers to all the questions. You can't believe it, but it is the truth. I'll tell you how this works out.

A person enters the exam room, takes his exam as quickly as possible, then goes away and walks to a parked car or a hotel room. In this car or hotel room, his friends are waiting for him and they sort out in no time the correct answers to the questions. They do this with the help of some smart guys and a couple of books. Now they transmit all the answers by radio into the exam room, where their friends are waiting with their receivers. Although the check-in at the exam room is very sharp, some manage to bring their receivers along.

You can imagine that the Dutch Radio Control Service does a lot of radio direction-finding at the exam. When I heard this story for the first time, I thought it was a joke! However, last year I heard it with my own ears on the FM band of my car radio.

NEW ZEALAND

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ZL PREFIX CHANGES

NZART made proposals to the regulatory body, the New Zealand Post Office, that separate prefixes should be allocated to the Chatham Islands, the Kermadecs, and the Auckland/Campbell Islands instead of the present /C, etc., method of identification.

The proposals were adopted, and from January 1, 1984, the ZL0–9 series will be used as follows: ZL0—for visitors to New Zealand (no change); ZL1–4—for mainland New Zealand, i.e., North Island, South Island, and Stewart Island (no change); ZL5—Antarctica (no change); ZL6—New Zealand Intruder Watch (no change); ZL7—Chatham Islands; ZL8—Kermadecs; ZL9—Auckland/Campbell Islands.

The ZK series will be as follows: ZK1—Cook Islands (no change); ZK2—Niue (no change); ZK3—Tokelau Islands (previously ZM7); ZK0, ZK4–9—reserved.

The ZM0–9 series will continue to be held in reserve and used on special occasions at the discretion of the Post Office. So, prefix hunters and all other interested amateurs, as of January 1, 1984, there will be a few more prefixes available by working the New Zealand off-shore islands under their new callsigns.

THE AREC STORY CONTINUED

AREC in ZL today consists of about 75 Sections and between 800 and 900 active members. Because there are more AREC Sections in Auckland and Wellington regions than there are callsigns in the ZL1E and ZL2E series, the New Zealand Post Office has approved the use of ZL6E calls in the Auckland region and ZL7E calls in the Wellington region. So when you hear such calls as ZL6EBA and ZL7ECA, they are not a pirate station or some rare DX, but Amateur Radio Emergency Corps stations in the Auckland and Wellington regional areas operating emergency communications networks. Who knows what the next 50 years will bring? A massive increase in the South Island population could mean ZL8E and ZL9E callsigns for AREC.

Two features of AREC in ZL are unique. Both stem from the Post Office recognition of the Radio Emergency Corps from its inception.

The first unique feature is the distinctive callsign series allocated for AREC stations in which the first letter of each callsign following the prefix is always an "E". The special "E" callsigns identify stations engaged in emergency communications and warn other amateurs not to interfere with what may be urgent or vital traffic. No other country has the advantage of such a system.

The other feature is the allocation of spot frequencies within or on the edge of the amateur bands specifically for AREC use. These are 3500 kHz, 3900 kHz, 7100 kHz, and the exclusive band of 1900–1925 kHz. Other frequencies may also be used for AREC communications when and as required.

In the early days of AREC, all equipment was home-built and performance varied considerably depending upon the skill of the constructor and the skill of the operator. Initially, all operation was on CW. All operators were amateurs who, when involved in field searches, had to be fit enough to travel with the search parties and carry the extra weight of their radio equipment, too!

The postwar years saw the adaption of war-surplus equipment for AREC use. Subsequently, special radio equipment was developed and produced for AREC use, initially AM and CW, and in the last few years, SSB, the present AREC sets for field work being TR 105s, while most base stations and field-search HQ stations are modern-day transceivers suitable for operation from emergency power supplies.

The advent of modern amateur equipment has revolutionized AREC operations, operators now being able to use complex equipment that was not dreamed of in years gone by. Just as HF equipment had become plentiful for amateurs, the migration of VHF amateurs to the 2-meter FM band and the establishment of repeaters has revolutionized mobile and portable operation.

The facilities for purely local communications are excellent, and because most VHF equipment is easily portable, its suitability for emergency and Civil Defense applications is obvious. With VHF links between the search teams and field-search HQ, now the amateurs do not have to carry heavy equipment, but just a light hand-held with an additional battery supply, and they are good for several hours of search and rescue work.

Two organizations have been established and developed along with AREC since 1948. The first of these, the Search and Rescue Organization, is sponsored primarily by the Civil Aviation Division of the Ministry of Transport and the Police Department. Any search for missing persons or for missing aircraft comes under the control of one or the other of these government departments, and AREC has the continuing role in the provision of communications to and from the field and frequently in the field as well. AREC is financed by an annual grant from the Search and Rescue Organization.

AREC also has a role in the Civil Defense Communications Network, providing the communication between Civil Defense Headquarters and the Sector Posts in most Civil Defense areas.

The present Officer Commanding of the ZL AREC, Ron Morgan ZL2GQ/ZL2EX, is quoted here to conclude this resume of the emergency amateur service as it exists in New Zealand:

"As the latest in the line of OCs of AREC, I am aware of the work, the planning, and the efforts that have been put into the development of the AREC of today by my predecessors and conscious of the need to continue to make every effort to preserve the good repute in which the Corps is held. To me, amateur radio is the greatest hobby in the world. AREC is the aspect of amateur radio that can be of service to the community, and in return for the privilege of enjoying the hobby, I believe that I, and every other ZL radio amateur, too, owes support to the Corps."

AWARDS

Remember the Hastings Centennial Award, 0001 hours GMT, February 1, 1984, until 2400 hours GMT, February 29, 1984. All bands, all modes; see last month's column for details of contacts required.

BITS 'N' PIECES

Recently, another World Communications Year activity took place at the Hawkes Bay Royal Show (County Fair) when the Napier and Hastings Branches of NZART combined to display amateur radio to the public. During the three days of the Royal Show, the combined Branches were allocated the special callsign of ZL9WCY and operated amateur stations from the display stand at the show. Also, they had static displays of AREC equipment, old and present day, some vintage radio equipment, and present-day transceivers.

There were three working amateur stations, one on 20/15/10 meters, one on 40 meters, and the other on 2 meters for local communications. Propagation was not good for the HF bands, but some excellent QSOs were made with US amateurs and others that helped to demonstrate amateur radio to the public.

There was a third section to the display where the public could touch special display items such as a vintage receiver tuned to the local broadcast station, with the output fed into a scope showing the patterns of the carrier and the sound/speech. These "touch" display items proved very popular with young and old alike.

In an earlier column, when I described the national organization of amateur radio in ZL, it has been pointed out to me that I failed to indicate clearly the method by which our president is chosen.

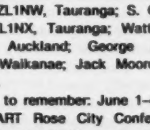
NZART is probably one of the few national radio organizations where the members elect the president every two years. For the biennial elections, nominations are called for all offices, including that of the president, so here in ZL the members of NZART elect their president, unlike other national organizations which appoint from one of the elected council or executive.

February is the month when all NZART Branches are making feverish preparations for the National Field Day Contest. This year, so I'm told, there will be a special YL team operating one of the non-active Branches somewhere in the North Island.

Good luck to the YL team; the extra multiplier and contact points will be appreciated by all National Field Day participant teams.

More 50-year certificates to members of the ZL Old-Timers Club have been issued. Congratulations to the following: M. D. Mason ZL1NW, Tauranga; S. C. Baveystock ZL1NX, Tauranga; Watty Briden ZL1PN, Auckland; George Anderson ZL2JG, Waikanae; Jack Moore ZL2JM, Fielding.

Dates to remember: June 1–4, 1984—the NZART Rose City Conference at Palmerston North. If you are planning a trip to ZL about that time, you will be most welcome at our annual convention. Enquiries to the Rose City Conference, PO Box 1718, Palmerston North, New Zealand, or to me at my home QTH.



NORWAY

Bjorn-Hugo Ark LA5YJ
N-3120 Andebu
Norway

Since my last column there have been some interesting activities in Norway. Of special interest was the yearly national convention of NRRL, held in Bodo, in northern Norway. This year's elections seemed both to underline the differences between the HQ members and the ordinary member and to smooth them out. I guess that's what democracy is all about, is it not?

Mr. Odd Andersen from the Norwegian Telecommunication Direktorat in Oslo gave a speech on the new license regulations expected to be issued. Word about a promised A license of 600 Watts output was very popular information for the nearly 100 members gathered—representing about a third of the total voting membership.

At a DX session earlier that morning, Alf Almedal LA5QK announced that they are at work getting Peter I Island recognized as a new DXCC country (which by now may already have been confirmed). He also said that a Norwegian Antarctic expedition will take place in late 1984, and that they were working to see that some of the members of that expedition will be ham operators. Rangnar Scholberg LA7FD and Mathias Bjerrang LA5NM, well-known operators from JX- and JW-land, held an interesting session about operation from the Arctic.

The convention was an absolute success, and the two local sections of NRRL, the Bodo and Fauske groups, could not have been praised more for their excellent planning and the smooth-running sessions.

DX CONVENTION

At the annual DX convention in Oslo, most of the eastern Norway members of the LADX group were gathered to elect a new president and members of the board. An unfortunate accident to Stig Lindblom LA7JO a week before kept members from central Norway away from the convention and kept the mood of the meeting rather low. Happily, LA7JO survived the fall from his 16-meter (48-foot) tower. He fell head first, and it is a mystery how he was able to survive without any greater harm than broken and crushed arms, although his condition was very serious for the first couple of days.

Svein Ovenstad LA3XI was elected as the new president of the LADX group. His predecessor was the late LA1KI, and the presidential chair had been empty for nearly a year since no one really wanted to touch the memory of our highly respected and beloved friend LA1KI, Norway's well-known top DXer for many years. The members of the board ran the LADX group in the meantime and did a good job.

Kare LA2GV was presented the trophy for being the top-score Norwegian operator in the SAC contest, 1982, in the single-operator/allband class. LA2GV had won the same trophy before, and I had the great pleasure of receiving the trophy on his behalf.

The LADX group is now looking into how to get SM@AGD to come over and talk about his DXpeditions to our members; it also is involved with a couple of rather interesting projects which the board seems to be keeping secret!

Odd Andersen speaks at the NRRL convention.

MALPELO DXPEDITION

Hurray, Colombia! You did it! HK@TU (Malpelo) went on the air. The whole world was waiting, and *you* gave it to us. And congratulations for an excellent operation, which must have been very thoroughly prepared, with a touch of the good old days in it: not a foul word, no irritation over the often-too-eager operators trying to work them. This operation was something all the members of that crew could be proud of.

We here in Europe too well remember a certain PY@ operation not too long ago which will go into legend as one of the poorest SSB operations from a rare place in years. But a German group put that all right again. That group actually always does a good job, so anything else from that side would have been a shock. The Colombians did their effort to straighten this out in a tremendous manner. Thanks again, guys; good work.

DXers, well, it's time to look for Europe on the lower bands again.

40 has as always been very good, but when you are reading this, 80 and 160 will be at their peak to many areas. Remember, keep clear of the DX windows. You never know, day or night, when the bands will open. Most of the day and night there will be openings from Scandinavia both on 40 and 80 meters, toward North America and Japan. Listen in if you're interested in some good DX QSOs.

New countries we all are waiting for include Kermadec, Clipperton, China, Bouvet, Peter I Island, and San Felix. When will they come? Kermadec is due, China has been worked by many, but the rest? We'll wait and see, won't we? The thrill of a new one is always there, and the pleasure after working it, as well. Hours of strained listening, intensive calling, and then the feeling of your heart doing a couple of extra beats when your call is returned. And then the nervous tremble in your voice when confirming and giving your report, that's what it's all about! Thanks to the guys giving us that pleasure of working them.

PAPUA NEW GUINEA

Seigi Freymadl P29NSF
PO Box 165
Rabaul
Papua New Guinea

This will be my last contribution from Papua New Guinea. In fact, as I write this, the station has already been dismantled and the antennas have been taken down. All the ham gear is packed and en route to VK. P29NSF went QRT on October 3, 1983, and will reemerge as VK4VSF from Brisbane.

We have spent 22 years in Papua New Guinea and been witness to great changes in the country. We have seen the peaceful transgression from Australian administration to self-government to independence in 1975. We have seen a people emerge from the Stone Age into the 20th century. I have been a P2 amateur for 3½ years and enjoyed it immensely. An excellent location, good equipment, and a husband ready to indulge every whim connected with amateur radio made it a pleasure to operate. It has been fun being a DX station; being at the receiving end of pileups gives you a good feeling and it is very good experience. However, at times I have had to go QRT because some operators have no discipline or manners.

On September 20, 1983, at 0153 GMT, I worked VK4MAL aeronautical mobile, operator Barry, on 15m en route to Biak in West Irian, thence Manila and Hong Kong. There is quite a story attached to this one.

The aircraft, a 41-year-old DC3, saw service with the US Army during World War II and was bought by a retired pilot who flew it to Hong Kong for Cathay Pacific. It became that airline's first aircraft and flew the Hong Kong-to-Sydney run carrying passengers and mail.

In 1963, the old girl was sold to Mandated Territory Airline (MAL, hence the callsign) and flew in Papua New Guinea for 10 years. When Ansett Airlines of Papua New Guinea bought out MAL, the DC3 went to bush pilots of Queensland. The DC3 played a major role for bush pilots for another 10 years.

Now Cathay Pacific has bought the old bird back to display her in their museum in Hong Kong. A fitting retirement! The aircraft made a nostalgic flight into Port Moresby on September 19 under its original Cathay registration, VR-HDB, on one side and the Mandated Territory registration, VH-MAL, on the other side. The aircraft is painted in original Cathay Pacific colors.

After refueling in Port Moresby, the DC3 flew to Wewak and made an overnight stop there. I worked the station VK4MAL aeronautical mobile en route Wewak to Biak and consider myself privileged to have had the contact.

The aircraft was due in Hong Kong in time for the 37th anniversary of Cathay Pacific on September 23. Every "Territorian" has a soft spot for DC3 aircraft, as they gave wonderful service to the traveling public in this country in the past. Many a time have we flown "side-saddle" in a DC3! Nowadays Boeing 707s and F28s are used by Air Niugine, but several

The author has the pleasure of presenting a trophy to Kare LA2GV. He was the top-score Norwegian operator in the SAC contest in 1982.

Jorgen LA5UF and Svein LA3XI were represented among the top ten DXers in Norway.

DC3s are still with the Papua New Guinea Defense Force.

What news from the P2 amateur scene? A new arrival is Bob P29PR, ex-VS5RP and -G3REP. Bob has just joined the Post and Telecommunication Corporation in Port Moresby. He has a Kenwood TS-180 and is active mainly on CW on all bands. Bob hopes to put P2 back on the CW map! His favorite band is 1.8 MHz, but he has found the noise level extremely high. Bob reports reasonable success on 80m, but as yet has not managed to get into W-land on that band.

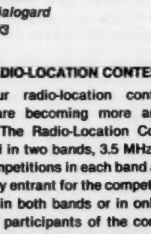
No doubt the ranks of amateurs will be swelled in Papua New Guinea as the OK Tedi Mine becomes fully operational in the Western Province. Already on the air from Tabubil are John P29NJS and Stan P29SO.

The Papuan Motor Sports Club in Port Moresby held its annual Independence Weekend Car Rally starting at 6 pm on September 14 and ending at 9 am on September 18. Throughout the event, communications were maintained by members of the Papua New Guinea Amateur Radio Society. The communications aspect was an unqualified success with stations working through the Moresby repeater and simplex, and as the rally moved further away from Port Moresby, on 40m during the day and on 80m at night.

Twenty-seven teams participated in the rally, amongst them six entries from Australia. Operating from O car was Peter P29NUK/ZUK, maintaining contact; the director of events, Wayne P29ZWW, upheld communications from another vehicle; the vehicle setting up control was manned by Bob P29BS. Finally, and bringing up the rear in the sweep vehicle, a sturdy 4WD to ensure that all cars had managed to get through safely, was Paul P29NPL. Manned relay stations were in operation, as well as field stations, and Rick P29ZFS was working as a manned 2m repeater. The complete success of the Independence Weekend Car Rally has convinced organizers to hold similar events throughout the year and Peter P29NUK intends to participate as navigator in the next one. Good work by the PNGARS!

The weekend of October 15–16 saw activity for the Jamboree of the Air and the Governor General of Papua New Guinea opened the event on P29JOA. Widespread interest was created, not only amongst guides and scouts, but also among police cadets with a view to forming a police radio club.

So much from me and from Papua New Guinea and my best wishes to everyone.

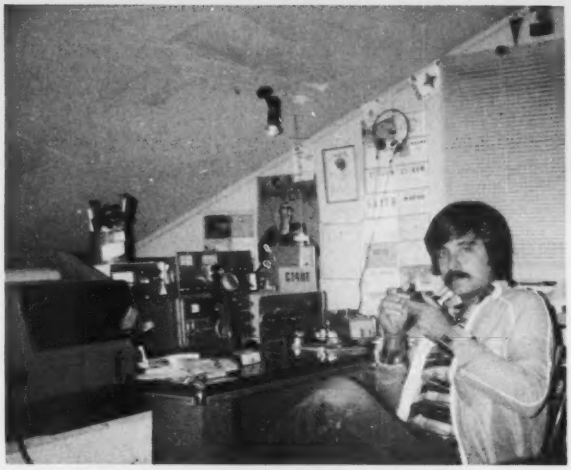


POLAND

Jerry Scymczak
78–200 Bialogard
Buczka 2/3
Poland

RADIO-LOCATION CONTEST

Amateur radio-location contests in Poland are becoming more and more popular. The Radio-Location Contest is organized in two bands, 3.5 MHz and 144 MHz. Competitions in each band are separate. Every entrant for the competition can compete in both bands or in only one of them. All participants of the contest are divided into the following categories:
(a) women irrespective of age;
(b) teenagers (boys and girls under 15 on January 1st of the year of the contest);



CT4UE in his shack.

(c) juniors under 18;
(d) men more than 18;
(e) seniors over 40.

Women, juniors, and men are appraised as a collective and as a team. The teams taking part in the top competition—the championship of Poland—represent provinces. The number of partakers from any province is to be limited to three in all categories. Individual contestants can take part in other competitions.

Every participant in the contest brings a radio receiver with antennas of one's own, a magnetic compass or the other one, a wristwatch, and a medical certificate of one's health. The use of a radio receiver with noises detectable at a distance of 10 meters is forbidden.

The organizer of the contest provides every participant with a map of the contest terrain. The terrain of the contest is to be predominantly arboreous and differences in its levels cannot be greater than 200 meters.

Five radio transmitters are to be placed at distances not less than 750 meters from each other. The overall length from the start through transmitter number 5 is to be 4–6 kilometers measured on the map. The transmitters are to be hidden so as not to be seen at a distance of 3 to 5 meters. The transmitters must not be placed in buildings or impenetrable places.

In each band, work the 5 transmitters successively: first minute—transmitter number 1, second minute—transmitter number 2..., fifth minute—transmitter number 5, sixth minute—transmitter number 1, and so on.

The emission A1 (telegraphy without modulation) is used in the 3.5-MHz band and A2 (telegraphy with modulation) is used in the 144-MHz band. Recommended keying rate is 30–45 marks /minute. All the transmitters are to operate best at the same frequency: 3500–3600 kHz in the 3.5-MHz band, and 144.500–144.845 kHz in the 144-MHz band. The power output of transmitters is to be 3–5 W and the stability of frequency not worse than 0.05%.

After a start signal one minute before the keying of the first transmitter, competitors in five-man groups run along alleyways 50–250 meters in length. When they are at the ends, their radio receivers are switched on and they begin to look for the transmitters. The sequence of detection is optional; however, transmitter number 5 must be found obligatorily and as the last. Transmitter number 5 ends its keying when all the competitors reach their goal. The time of the race and the number of detected transmitters determine one's place in the contest.

PORTUGAL

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2765 Portugal

It is with great pleasure and personal satisfaction that I write this first column for *73*. I will emphasize some aspects of the oldest association of radio amateurs we have in Portugal, known as REP—Rede dos Emissores Portugueses.

REP was first founded in December of 1926 by Mr. D. Eugenio de Avilez, formerly CT1AE, and other enthusiasts. It now has approximately 1900 members, more than 50% of the Portuguese hams. In 1980, it was recognized as a public utility by the government.

According to REP's constitution, we have elections every two years to elect our Board of Directors, and an Annual General Meeting is held to present and approve reports of the past year, including the accounts.

Being a member of IARU, REP offers a lot of services to its members. These are a few of them: reception and shipment of QSL cards from and to other bureaus, handling the paperwork required for examinations and new licenses, renewal of fixed, mobile, or portable licenses, supply of technical books, and publication of the REP magazine or an informative sheet every three months. In either of these two publications, members have the latest news about DX, electronics, awards, telecommunications via satelite, and other important matters.

Every year, we celebrate our anniversary and have a regional contest on VHF and HF with all the Portugese regions (CT1/4, CT2, CT3).

On Mondays at 2230 local time, a radio bulletin is transmitted by CT1REP through the repeaters and also on 80-meter phone. In addition to this, REP gives assistance to all foreign hams who wish to operate from this country. For those interested, we only need a letter requesting this service.

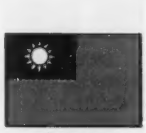
Owing to the existence of reciprocal agreements with some countries, it is very easy to operate from Portugal. At this time, we have reciprocity with the following countries: West Germany, Austria, Belgium, Denmark, Holland, Switzerland, Sweden, United States of America, England, Canada, Morocco, Brazil, Venezuela, South Africa, and Bolivia. More details about this will be given in the future.

The station that we have in REP is composed of a Yaesu transceiver (FT-902 DM), an FC-902 antenna coupler, an SP-901 external speaker, and an FV-901 DM, all this offered by Yaesu Musen in Japan. We also work on VHF using a Kenwood transceiver.

On the air, mostly around the DX frequencies, we might hear Portuguese hams using several modes of transmission—SSB, CW, SSTV, and RTTY. Some of them (very few) are also active through the satellites for ham use. It may be of interest to you to know that we have 15 repeaters on VHF and 2 on UHF.

We have our weekly meeting on Monday at 2100 local time. If you are in Lisbon, you are kindly invited to visit REP's headquarters, right in the heart of Lisbon. Last November, our good friend Frank Rose W1TIV came to see us and signed the Honour's Book.

Our address is Rua D. Pedro V, 7-4º, phone 361186. Just in case you forget the address, you may contact me at phone number 2688318 during the evenings.



TAIWAN

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PO Box 30–547
Taipei, Taiwan 107
Republic of China

To direct the attention of our people to the contribution of communications toward world peace and social developments, the Directorate General of Posts, Republic of China, has released a set of two stamps for commemorating the World Communications Year. Also, Chinese Posts and Telecommunications Department has finally granted permission to a group of Italian hams allowing them to operate in Taiwan.

The DXpedition group, consisting of three members (instead of four as previously reported) of the ARI DX Blue Team (I2MQP/BV, I2BVS/BV, and I2NYN/BV) arrived in Taipei on September 18 via KLM Airlines. They were settled in a new hotel, "Long Life," close to BV2A/BV2B.

On September 19, Mr. Hu, secretary of the China Radio Association, lent hands to take delivery of two transceivers (IC-740, IC-2KL) and accessories from the customs at the CKS International Airport, 45 kilometers from Taipei City. A deposit equivalent to US $150 approximately instead of customs duty payment was placed for warranty of shipping all imported articles out of the country (ROC) within six months. As a matter of fact, all rigs after operation were duly reshipped out and the deposit money was refunded without any problem.

The imported equipment with a 2-element yagi and a vertical tribander were set up at a QTH near a public park on the roof on a 12-story building which is specious for antenna installations and good for both receiving and transmitting purposes. The DXpedition station was dismantled on September 24, a half day earlier than the set schedule because of a strong developing and approaching typhoon.

This initial expedition activity was highly evaluated by us. Local authorities are glad to see that through amateur radio, we have

done a lot in promoting international goodwill and friendship between people of the world. Making eyeball QSOs further enhances better understanding.

Some local important newspapers—*The United Daily, The China News Agency,* and *The English China News*—had good comments on the worldwide friendly movements of amateur radio. This has brought to the attention of the public the progressive quality and unique relations existing in this field.

All visitors were entertained by the China Radio Association at the Army Officers Club. They were introduced to many important officials at the party. Before their departure for home in Milan, a sight-seeing tour was arranged for them to visit the National Palace Museum, where they found great pleasure and relaxation.

I am pleased to have contacted I2MQP/BV, I2BVS/BV, and I2NYN/BV to offer them a new country credit; it also made my day to have the two-way communications domestically.

I hear a group of JAs are planning to make a DXpedition to BV-land in January, 1984. I shall report in due course.

SWEDEN

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Sweden

FOX HUNTING

Eskilstuna Sandare Amatorer, Club SK5LW, hosted the 1983 Swedish Championships in Amateur Radio Direction Finding (ARDF), popularly called fox hunting.

The championship is a combination of one daytime and one nighttime hunt. Winner in this combination was Christer Eriksson followed by Gunnar Svensson, a well-known name in these circles here. Neither of them is a ham; this is a sport for anybody. Leif SM5EZM was third but winner of the day event. The total number of participants was 50, of which there were two YLs. Kurt SM5OW, at 65 years of age an old-timer in ARDF, placed 39th and is still going strong.

The "foxes" were five very-low-powered transmitters on 80-meter CW hidden in the woods. The hunters were equipped with maps, compasses, and small ARDF receivers. At night, a flashlight was needed. Some hunters said that they preferred rainy weather because then they didn't hesitate when they crossed a swamp since they were already wet!

DX MEETING IN OREBRO

Club SK4BX, Orebro Sandaramatorer, arranged the popular annual gathering of Swedish DXers. SK4BX is a very active club some 150 km west of Stockholm. The club members always participate in major contests and the QSL cards on the walls show that SK4BK is successful in the DX pileups. The club runs one repeater on VHF 145.650 MHz, and one on UHF 437.650 MHz, as well as a UHF beacon on 432.960 MHz.

In early 1982, the club moved into a fine building (restored by the members) located just outside the city of Orebro. This QTH has great antenna possibilities and the lack of immediate neighbors minimizes the risk of TVI/RFI complaints. The antenna tower is 40 meters high (130 ft.) with a TH5DX beam just under the 20-element Cue Dee yagi for 2 meters. Other antennas are for 160, 80, and 40 meters, and in the planning stage is an EME array for 70 centimeters.

The ARI DX Blue Team in Taiwan. Left to right: I2BVS/BV, I2NYN/BV, BV2A/BV2B, and I2MQP/BV.

Over 50 DXers got to meet in Orebro, some coming from as far away as the most southern part of SM7, an eight-hour drive by automobile. The top attraction was the talk and slide show by Erik SM0AGD, member of the DX Hall of Fame. During the last ten years, Erik has made quite a few very successful operations from the most rare spots throughout the DXworld.

Being a top-grade CW operator, he has made CW buffs as well as SSBers happy. During the last eight months of 1982, Erik toured the rare South Pacific islands and worked 47,260 contacts.

He tried to limit the number of slides to less than 300, but his interesting and witty comments during the two-hour talk made everybody wish he had brought more. The last slides showed his QSL manager, Joergen SM3CXS, plodding his way to the mailbox through five feet of Nordic December snow to pick up the daily pounds of QSL cards. Joergen has now bought a snowblower to speed up future QSLing.

The club's own DXpedition last summer to OJ0 Market Reef was shown by a professionally made film with authentic recorded sound. Goran SM4DHF, Kenneth SM4EMO, and Goran SM4HQO had to halt their operation after two days because of additional paperwork requested by the Finnish licensing authorities which luckily was resolved. During that silent period, they moved their rig and antenna a few feet east on the tiny reef and worked portable SM5! Market Reef is divided by the Finnish-Swedish national border.

SK4BX had furthermore managed to get a video recording from the Heard Island DXpedition slide show narrated by Jim VK9JKS himself.

SWEDISH HAMS DENIED SPECIAL WCY CALL

The United Nations declared 1983 as World Communications Year. In most countries, both the telecommunications authority and the radio amateurs have acknowledged the WCY by various special activities. One way of giving WCY publicity in many countries has been the issuing of special WCY callsigns. In Sweden, the league, SSA, applied for this kind of a call (suffix) to be used by club stations in each call area. However, the Swedish licensing authority, Televerket, has rejected this application.

MOTIONS TO IARU REGION 1 CONFERENCE

The International Amateur Radio Union (IARU) Region 1 Division was formed in 1950 to promote the special interests of the member societies in the International Telecommunication Union Region 1 (Europe, Africa, and parts of Asia) and to represent their interests at ITU conferences.

The Swedish amateur radio league, SSA (Sveriges Sandare Amatorer), has sent three motions to the IARU Region 1 Conference 1984. The first motion is about the Worldwide Grid-Locator System. In Europe, one system has been used for years, primarily in VHF/UHF traffic. It is extremely popular amongst VHF/UHF enthusiasts to collect locator squares in a manner similar to hunting for DXCC countries. The new worldwide locator system was accepted by Region 2 at the Cali Conference in Colombia in 1983, to be used in contests and for awards. Region 3 has also accepted this. The motion from SSA suggests an acceptance by Region 1 and implementation on January 1, 1985. Basically, the world surface is divided into fields by 18 lines longitude and 18 lines latitude. These fields are divided into squares that are 2 degrees longitude and 1 degree latitude, which will give very good accuracy in determining QTH position.

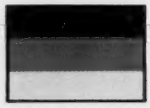
The second motion concerns the timing system for EME traffic which is different on 144 MHz than on 432 and 1296 MHz. The SSA wants the IARU to recommend uniformity as well as a timing system with one-minute sequences.

The third motion: Because of the collision between the satellite traffic and the Region 1 VHF band plan for repeater channels R8 and R9 on 145.800 and 145.825 MHz respectively, the SSA suggests one solution: channel R9 should be moved to 145.575 MHz (output). The beacons that might be interfered with on 144.975 MHz (input) should be moved. If and when the satellite organizations move away from 145.825 MHz, R9 repeaters could move back to their original frequency.

Furthermore, the SSA suggests that each IARU member society issue an amateur-radio traffic handbook in their own language, in addition to articles about rules and regulations, to be published in the member magazines. The lack of obedience concerning international telecommunication rules and regulations might partly be due to lack of knowledge and understanding.

SSA MEMBERSHIP FEE

The 1984 membership fee is 195 Swedish kronor (approximately 25 US dollars). The league issues the membership magazine, *QTC*, eleven times a year, runs the QSL bureau, and serves Swedish radio amateurs in various important ways. The work for the club is done voluntarily. The only salaried employees are clerks at the headquarters in Stockholm.



WEST GERMANY

Ralf Beyer DJ3NW
Opferkamp 14
3300 Braunschweig
Federal Republic of Germany

INTERRADIO '83

On the world's largest fairgrounds, the Interradio '83 opened its gates from October 28–30, 1983, in Hannover, Germany.

Because of the size of the exhibition area and the various activities taking place at the same time, I first found myself at a poultry show. But finally I arrived at hall 19, the place to meet radio amateurs, computer freaks, electronics hobby enthusiasts, and a fair number of equipment and component manufacturers.

The approximately 50 booths were occupied by a dozen equipment manufacturers, half a dozen computer firms, a similar number of component manufacturers/distributors, and some firms offering software support, books, and miscellaneous material needed to organize the ham shack. More than a dozen institutions were represented, including the national radio-amateur organization DARC, AMSAT-DL, DIG, and others.

About 8500 people, including the presidents of national radio-amateur societies from England, Luxembourg, Sweden, Spain, and The Netherlands, visited the convention and many of them took the opportunity to join the presentations provided in two meeting rooms. Papers presented included AMTOR, EME, and OSCAR 10. An indoor "Bier-Garten" provided plenty of room for get-togethers with old and new friends and for the usual small talk.

The meeting of the DXers saw about 100 participants and Baldur Drobnica DJ6SI showed a film about his earlier Glorioso and Juan da Nova DXpedition. Baldur answered questions on the ill-fated tour to Spratly, of course, but fortunately he was not forced to dwell on the details over and over again.

About 250 young students were shown around and many of them joined classes held on fundamentals of electronics and hands-on exercises for the construction of small electronics projects. More than 100 kits for easy-to-build electronic circuits and 60 kits for experiments with a microprocessor were sold at the show.

I enjoyed the meeting very much because of the variety of stimulating impressions, but I could not find anything on the international level which really turned me on. However, at least one interesting idea in this respect was the discussion of better support for future European DXpeditions. Existing plans to form national DX foundations seem to be channeled more and more towards a European DX foundation. A more sound financial support of DXpeditions and a better service of European needs in this field could be desirable outcomes of this move.

RAMSEY ELECTRONICS Inc.

PARTS WAREHOUSE

We now have available a bunch of goodies too good to bypass. Items are limited so order today.

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Penfield, NY 14526
716-586-3950

Call your Phone Order in Today. TERMS: Satisfaction guaranteed or money refunded. C.O.D. add $2.50. Minimum order $6.00. Orders under $10.00 add $1.50. Add 6% for postage, insurance, handling. Overseas add 15%. N.Y. residents add 7% tax.

MINI KITS - YOU HAVE SEEN THESE BEFORE NOW HERE ARE OLD FAVORITE AND NEW ONES TOO. GREAT FOR THAT AFTERNOON HOBBY.

FM MINI MIKE

A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available.

FM-3 Kit **$14.95**
FM-3 Wired and Tested **19.95**

Color Organ

See music come alive! 3 different lights flicker with music. One light each for, high, mid-range and lows. Each individually adjustable and drives up to 300 W. runs on 110 VAC.

Complete kit, ML-1 **$8.95**

Video Modulator Kit

Converts any TV to video monitor. Super stable, tunable over ch 4-6. Runs on 5-15V, accepts std video signal. Best unit on the market! Complete kit, VD-1 **$7.95**

Led Blinky Kit

A great attention getter which alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights, anything! Runs on 3 to 15 volts. Complete kit, BL-1 **$2.95**

Super Sleuth

A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2 W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker. Complete kit, BN-9 **$5.95**

CPO-1

Runs on 3-12 Vdc 1 watt out, 1 KHZ good for CPO, Alarm, Audio Oscillator. Complete kit **$2.95**

FM Wireless Mike Kit

Transmits up to 300' to any FM broadcast radio, uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage.

FM-1 kit **$3.95** FM-2 kit **$4.95**

Whisper Light Kit

An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Includes mike, controls up to 300 W, runs on 110 VAC. Complete kit, WL-1 **$6.95**

Tone Decoder

A complete tone decoder on a single PC board. Features 400-5000 Hz adjustable range via 20 turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts. Complete kit, TD-1 **$5.95**

Universal Timer Kit

Provides the basic parts and PC board required to provide a source of precision timing and pulse generation. Uses 555 timer IC and includes a range of parts for most timing needs.

UT-5 Kit **$5.95**

Mad Blaster Kit

Produces LOUD ear shattering and attention getting siren like sound. Can supply up to 15 watts of obnoxious audio. Runs on 6-15 VDC.

MB-1 Kit **$4.95**

Siren Kit

Produces upward and downward wail characteristic of a police siren. 5 W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker. Complete kit, SM-3 **$2.95**

60 Hz Time Base

Runs on 5-15 VDC. Low current (2.5ma). 1 min./month accuracy. TB-7 Kit **$5.50**
TB-7 Assy **$9.95**

CLOCK KITS

Your old favorites are here again. Over 7,000 Sold to Date. Be one of the gang and order yours today!

Try your hand at building the finest looking clock on the market. Its satin finish anodized aluminum case looks great anywhere, while six .4" LED digits provide a highly readable display. This is a complete kit, no extras needed, and it only takes 1-2 hours to assemble. Your choice of case colors: silver, gold, black (specify).

Clock kit, 12/24 hour, DC-5 **$24.95**
Clock with 10 min. ID timer, 12/24 hour, DC-10 **$29.95**

For wired and tested clocks add $10.00 to kit price.
SPECIFY 12 OR 24 HOUR FORMAT

SATELLITE TV KIT

THE POPULAR SAT-TEC RECEIVER IN KIT-FORM!

Image rejection, fully tunable audio to recover 'hidden' subcarriers, divide by two PLL demodulator for excellent threshold performance, tight tracking AFC to assure drift free reception, and of course, full 24 channel tunable coverage.

Build your satellite TV system around the R2B, close to ten thousand others already have and now it's available in kit form at a new low price. Order yours today.

NEW, LOWER PRICES!

Featured in a Radio Electronics magazine cover story (May 82), the reliable R2B Sat-tec TV receiver is now operating in thousands of locations. The R2B is easy to build; pre-etched, plated boards with screened component layout assures accurate component placement and the critical IF section and local oscillator are pre-assembled and aligned! All parts are included for the R2B; attractive case, power supply, descriptive operating manual as well as complete assembly instructions. Features of the receiver include; dual conversion design for best

A complete Satellite TV System requires a dish antenna, LNA (low noise amplifier), Receiver and Modulator.

R2B Receiver Kit	$295.00
R2B Receiver, Wired and Tested	$395.00
120°K LNA	$295.00
RM3 RF Modulator	$49.95

Prices include domestic UPS shipping and insurance.

PARTS PARADE

IC SPECIALS

LINEAR

301	$ .35
324	$1.50
380	$1.50
555	$ .45
556	$1.00
565	$1.00
566	$1.00
567	$1.25
741	10/$2.00
1458	$ .50
3900	$ .50
3914	$2.95
8038	$2.95

CMOS

4011	.50
4013	.50
4046	$1.85
4049	.50
4059	$9.00
4511	$2.00
4518	$1.35
5639	$1.75

TTL

74S00	$ .40
7447	$ .65
7475	$ .50
7490	$ .50
74196	$1.35

SPECIAL

11C90	$15.00
10116	$ 1.25
7208	$17.50
7207A	$ 5.50
7216D	$21.00
7107C	$12.50
5314	$ 2.95
5375AB/G	$ 2.95
7001	$ 6.50

FERRITE BEADS

With info and specs. 15/$1.00
6 Hole Balun Beads 5/$1.00

READOUTS

FND 359 .4" C.C.	$1.00
FND 507/510 .5" C.A.	1.00
MAN 72/HP7730 .33" C.A.	1.00
HP 7651 .43" C.A.	2.00

TRANSISTORS

2N3904 NPN C+F	15/$1.00
2N3906 PNP C+F	15/$1.00
2N4403 PNP C+F	15/$1.00
2N4410 NPN C+F	15/$1.00
2N4916 FET C+F	4/$1.00
2N5401 PNP C+F	5/$1.00
2N6028 C+F	4/$1.00
2N3771 NPN Silicon	$1.50
2N5179 UHF NPN	3/$2.00
Power Tab NPN 40W	3/$1.00
Power Tab PNP 40W	3/1.00
MPF 102/2N5484	$.50
NPN 3904 Type T+R	50/$2.50
PNP 3906 Type T+R	50/$2.50
2N3055	$.60
2N2646 UJT	3/$2.00

Sockets

8 Pin	10/$2.00
14 Pin	10/$2.00
16 Pin	10/$2.00
24 Pin	4/$2.00
28 Pin	4/$2.00
40 Pin	3/$2.00

Diodes

5.1 V Zener	20/$1.00
1N914 Type	50/$1.00
1KV 2Amp	8/$1.00
100V 1Amp	15/$1.00

25 AMP 100V Bridge **$1.50 each**

Mini-Bridge 50V 1 AMP 2 for $1.00

Resistor Ass't

Assortment of Popular values - ¼ watt. Cut lead for PC mounting. ½" center. ½" leads. bag of 300 or more. **$1.50**

Switches

Mini toggle SPDT **$1.00**
Red Pushbuttons N.O. **3/$1.00**

Earphones

3" leads. 8 ohm. good for small tone speakers, alarm clocks, etc. 5 for $1.00

Mini 8 ohm Speaker

Approx 2"x" diam. Round type for radios, mike etc. **3 for $2.00**

Slug Tuned Coils

Small 3/16" Hex Slugs turned coil 3 turns. 10 for $1.00

CAPACITORS

TANTALUM Dipped Epoxy	ALUMINUM Electrolytic	DISK CERAMIC
1.5 uF 25V 3/$1.00	1000 uF 16V Radial $.50	.01 16V disk 20/$1.00
1.8 uF 25V 3/$1.00	500 uF 20V Axial $.50	1 16V 15/$1.00
.22 uF 25V 3/$1.00	150 uF 16V Axial 5/$1.00	100 pF 20/$1.00
	10 uF 15V Radial 10/$1.00	.047 16V 20/$1.00

DC-DC Converter

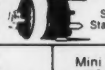
+5 vdc input prod. -9 vdc @ 30ma
+9 vdc produces -15 vdc @ 35ma **$1.25**

Ceramic IF Filters

Mini [illegible] 7 kHz B.W. SOLD OUT $1.50 ea.

Trimmer Pots

25K 20 Turn Trim Pot **$1.00**
1K 20 Turn Trim Pot **$ .50**



Trimmer Caps

Sprague - 3-40 pf Stable Polypropylene **.50 ea.**

Crystal Microphone

Small 1" diameter ¼" thick crystal mike cartridge **$.75**

Crystals

3.579545	MHZ	$1.50
10.00000	MHZ	$5.00
5.248800	MHZ	$5.00

AC Adapters

Good for clocks, nicad chargers, all 110 VAC plug one end.

8.5 vdc @ 20 mA	$1.00
16 vac @ 160mA	$2.50
12 vac @ 250mA	$3.00

Solid State Buzzers

small buzzer 450 Hz, 86 dB sound output on 5-12 vdc at 10-30 mA. TTL compatible **$1.50**

AC Outlet

Panel Mount with Leads **4/$1.00**

Mini RG-174 Coax **10 ft. for $1.00**

Coax Connector

Chassis mount BNC type **$1.00**

9 Volt Battery Clips

Nice quality clips **5 for $1.00**
¾" Rubber Grommets **10 for $1.00**

Parts Bag

Asst. of chokes, disc caps, tant. resistors, transistors, diodes, MICA caps etc. am. bag (100 pc) **$1.00** lg. bag (300 pc) **$2.50**

Connectors

6 pin type gold contacts for mA-1003 car clock module price **.75 ea.**

Leds - your choice, please specify

Mini Red, Jumbo Red, High Intensity Red, Illuminator Red **8/$1**
Mini Yellow, Jumbo Yellow, Jumbo Green **6/$1**

Varactors

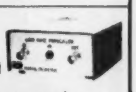
Motorola MV 2209 30 PF Nominal cap 20-80 PF - Tunable range - **.50 each or 3/$1.00**

Audio Prescaler

Make high resolution audio measurments, great for musical instrument tuning, PL tones, etc. Multiplies audio UP in frequency, selectable x10 or x100, gives .01 HZ resolution with 1 sec. gate time! High sensitivity of 25 mv, 1 meg input z and built-in filtering gives great performance. Runs on 9V battery, all CMOS.

PS-2 kit **$29.95**
PS-2 wired **$39.95**

600 MHz PRESCALER



Extend the range of your counter to 600 MHz. Works with all counters. Less than 150 mv sensitivity. specify -10 or -100

Wired, tested, PS-1B **$59.95**
Kit, PS-1B **$44.95**

30 Watt 2 mtr PWR AMP

Simple Class C power amp features 8 times power gain. 1 W in for 8 out, 2 W in for 15 out, 4W in for 30 out. Max output of 35 W, incredible value, complete with all parts, less case and T-R relay.

PA-1, 30 W pwr amp kit **$22.95**
TR-1, RF sensed T-R relay kit **6.95**

MRF-238 transistor as used in PA-1 8-10db gain 150 mhz **$11.95**

RF actuated relay senses RF (1W) and closes DPDT relay. For RF sensed T-R relay. TR-1 Kit **$6.95**

Power Supply Kit

Complete triple regulated power supply provides variable 6 to 18 volts at 200 ma and +5 at 1 Amp. Excellent load regulation, good filtering and small size. Less transformers, requires 6.3 V @ 1 A and 24 VCT. Complete kit, PS-3LT **$8.95**

OP-AMP Special

BI-FET LF 13741 - Direct pin for pin 741 co[illegible] but 500,000 MEG input z, super low 50 pa input curre[illegible] power drain. SOLD OUT

50 for only $9.00 **10 for $2.00**

Regulators

78MG	$1.25	7812	$1.00
79MG	$1.25	7815	$1.00
723	$.50	7905	$1.25
309K	$1.15	7912	$1.25
7805	$1.00	7915	$1.25

Shrink Tubing Nubs

Nice precut pces of shrink size 1" x ¼" shrink to ¼". Great for splices. **50/$1.00**

Mini TO-92 Heat Sinks

Thermalloy Brand **5 for $1.00**
To-220 Heat Sinks **3 for $1.00**

Opto Isolators - 4N28 type **$.50 ea.**
Opto Reflectors - Photo diode + LED **$1.00 ea.**

Molex Pins

Molex already precut in length of 7. Perfect for 14 pin sockets. **20 strips for $1.00**

CDS Photocells

Resistance varies with light. 250 ohms to over 3 meg **3 for $1.00**

See List of Advertisers on page 98

THE MOST AFFORDABLE REPEATER

ALSO HAS THE MOST IMPRESSIVE PERFORMANCE FEATURES

(AND GIVES THEM TO YOU AS STANDARD EQUIPMENT!)

JUST LOOK AT THESE PRICES!

Band	Kit	Wired/Tested
10M,6M,2M,220	$680	$880
440	$780	$980

Both kit and wired units are complete with all parts, modules, hardware, and crystals.

CALL OR WRITE FOR COMPLETE DETAILS.

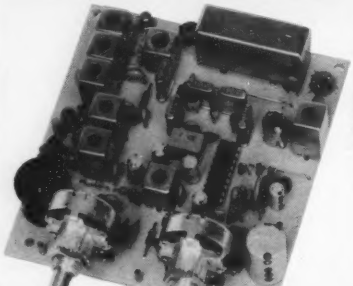
Also available for remote site linking, crossband, and remote base.

FEATURES:

- SENSITIVITY SECOND TO NONE; TYPICALLY 0.15 uV ON VHF, 0.3 uV ON UHF.
- SELECTIVITY THAT CAN'T BE BEAT! BOTH 8 POLE CRYSTAL FILTER & CERAMIC FILTER FOR GREATER THAN 100 dB AT ± 12KHZ. HELICAL RESONATOR FRONT ENDS. SEE R144, R220, AND R451 SPECS IN RECEIVER AD BELOW.
- OTHER GREAT RECEIVER FEATURES: FLUTTER-PROOF SQUELCH, AFC TO COMPENSATE FOR OFF-FREQ TRANSMITTERS, SEPARATE LOCAL SPEAKER AMPLIFIER & CONTROL.
- CLEAN, EASY TUNE TRANSMITTER; UP TO 20 WATTS OUT (UP TO 50W WITH OPTIONAL PA).

HIGH QUALITY MODULES FOR REPEATERS, LINKS, TELEMETRY, ETC.

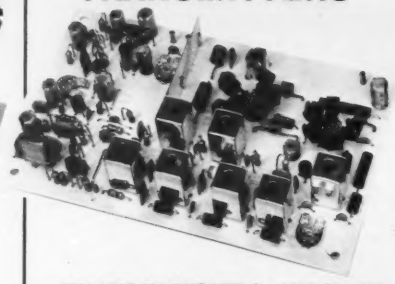
HIGH-PERFORMANCE RECEIVER MODULES



R144 Shown

- **R144/R220 FM RCVRS** for 2M or 220 MHz. 0.15uV sens.; 8 pole xtal filter & ceramic filter in i-f, helical resonator front end for exceptional selectivity, more than −100 dB at ±12 kHz, best available today. Flutter-proof squelch. AFC tracks drifting xmtrs. Xtal oven avail. Kit only $138.
- **R451 FM RCVR** Same but for uhf. Tuned line front end, 0.3 uV sens. Kit only $138.
- **R76 FM RCVR** for 10M, 6M, 2M, 220, or commercial bands. As above, but w/o AFC or hel. res. Kits only $118.
  Also avail w/4 pole filter, only $98/kit.
- **R110 VHF AM RECEIVER** kit for VHF aircraft band or ham bands. Only $98.
- **R110-259 SPACE SHUTTLE RECEIVER,** kit only $98.

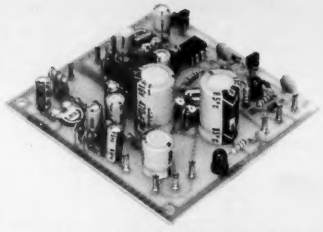
TRANSMITTERS



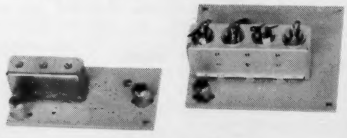
- **T51 VHF FM EXCITER** for 10M, 6M, 2M, 220 MHz or adjacent bands. 2 Watts continuous, up to 2½ W intermittent. $68/kit.

- **T451 UHF FM EXCITER** 2 to 3 Watts on 450 ham band or adjacent freq. Kit only $78.
- **VHF & UHF LINEAR AMPLIFIERS.** Use on either FM or SSB. Power levels from 10 to 45 Watts to go with exciters & xmtg converters. Several models. Kits from $78.
- **A16 RF TIGHT BOX** Deep drawn alum. case with tight cover and no seams. 7 x 8 x 2 inches. Designed especially for repeaters. $20.

ACCESSORIES



- **COR KITS** With Audio mixer, speaker amplifier, tail & time out timers. Kit only $38.
- **CWID KITS** 158 bits, field programmable, clean audio, rugged TTL logic. Kit only $68.
- **DTMF DECODER/CONTROLLER KITS.** Control 2 separate on/off functions with touchtones®, e.g., repeater and autopatch. Use with main or aux. receiver or with Autopatch. Only $90
- **AUTOPATCH KITS.** Provide repeater autopatch, reverse patch, phone line remote control of repeater, secondary control via repeater receiver. Many other features. Only $90. Requires DTMF Module.



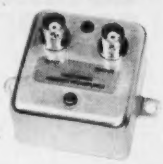
- **HELICAL RESONATOR FILTERS** available separately on pcb w/connectors.

  HRF-144 for 143-150 MHz $38
  HRF-220 for 213-233 MHz $38
  HRF-432 for 420-450 MHz $48

hamtronics® 33

NEW LOW-NOISE PREAMPS

New low-noise microwave transistors make preamps in the 0.9 to 1.0 dB noise figure range possible without the fragility and power supply problems of gas-fet's. Units furnished wired and tuned to ham band. Can be easily retuned to nearby freq.



Models LNA( ), P30, and P432 shown

Model	Tunable Freq Range	Noise Figure	Gain	Price
LNA 28	20-40	0.9 dB	20 dB	$39
LNA 50	40-70	0.9 dB	20 dB	$39
LNA 144	120-180	1.0 dB	18 dB	$39
LNA 220	180-250	1.0 dB	17 dB	$39
LNA 432	380-470	1.0 dB	18 dB	$45
LNA 800	470-960	1.2dB	15 dB	$45

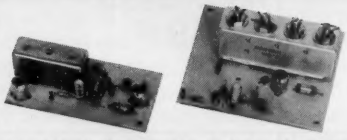
ECONOMY PREAMPS

Our traditional preamps, proven in years of service. Over 20,000 in use throughout the world. Tuneable over narrow range. Specify exact freq. band needed. Gain 16-20 dB. NF = 2 dB or less. VHF units available 27 to 300 MHz. UHF units available 300 to 650 MHz.

- P30K, VHF Kit less case $18
- P30W, VHF Wired/Tested $33
- P432K, UHF Kit less case $21
- P432W, UHF Wired/Tested $36

P432 also available in broadband version to cover 20-650 MHz without tuning. Same price as P432; add "B" to model #.

HELICAL RESONATOR PREAMPS



Our lab has developed a new line of low-noise receiver preamps with helical resonator filters built in. The combination of a low noise amplifier similar to the LNA series and the sharp selectivity of a 3 or 4 section helical resonator provides increased sensitivity while reducing intermod and cross-band interference in critical applications. See selectivity curves at right. Noise figure = 1 to 1.2 dB. Gain = 12 to 15 dB.

Model	Tuning Range	Price
HRA-144	143-150 MHz	$49
HRA-220	213-233 MHz	$49
HRA-432	420-450 MHz	$59
HRA-( )	150-174MHz	$69
HRA-( )	450-470 MHz	$79

RECEIVING CONVERTERS

Models to cover every practical rf & if range to listen to SSB, FM, ATV, etc. NF = 2 dB or less.

	Antenna Input Range	Receiver Output
VHF MODELS	28-32	144-148
	50-52	28-30
Kit with Case $49	50-54	144-148
Less Case $39	144-146	28-30
Wired $69	145-147	28-30
	144-144.4	27-27.4
	146-148	28-30
	144-148	50-54
	220-222	28-30
	220-224	144-148
	222-226	144-148
	220-224	50-54
	222-224	28-30
UHF MODELS	432-434	28-30
	435-437	28-30
Kit with Case $59	432-436	144-148
Less Case $49	432-436	50-54
Wired $75	439.25	61.25

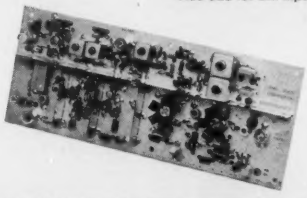
SCANNER CONVERTERS Copy 72-76, 135-144, 240-270, 400-420, or 806-894 MHz bands on any scanner. Wired/tested Only $88.

TRANSMIT CONVERTERS

For SSB, CW, ATV, FM, etc. Why pay big bucks for a multi mode rig for each band? Can be linked with receive converters for transceive. 2 Watts output vhf, 1 Watt uhf.

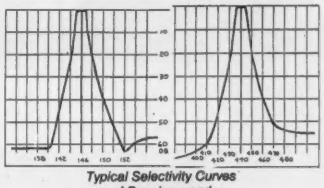
	Exciter Input Range	Antenna Output
For VHF,	28-30	144-146
Model XV2	28-29	145-146
Kit $79	28-30	50-52
Wired $149	27-27.4	144-144.4
(Specify band)	28-30	220-222*
	50-54	220-224
	144-146	50-52
	50-54	144-148
	144-148	28-30
For UHF,	28-30	432-434
Model XV4	28-30	435-437
Kit $99	50-54	432-436
Wired $169	61.25	439.25
	144-148	432-436*

*Add $20 for 2M input



VHF & UHF LINEAR AMPLIFIERS. Use with above. Power levels from 10 to 45 Watts. Several models, kits from $78.

LOOK AT THESE ATTRACTIVE CURVES!



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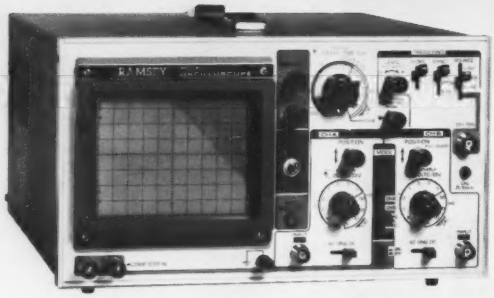

NEW FROM RAMSEY 20 MHz DUAL TRACE OSCILLOSCOPE

Unsurpassed quality at an unbeatable price, the Ramsey oscilloscope compares to others costing hundreds more. Features include a component testing circuit that will allow you to easily test resistors, capacitors, digital circuits and diodes • TV video sync filter • wide bandwidth & high sensitivity • internal graticule • high quality rectangular CRT • front panel trace rotator • Z axis • high sensitivity x-y mode • very low power consumption • regulated power supply • built-in calibrator • rock solid triggering • high quality hook-on probes

$399.95 high quality hook-on probes included

RAMSEY D-1100 VOM-MULTITESTER

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$19.95

test leads and battery included

RAMSEY D-2100 DIGITAL MULTITESTER

A compact easy to use unit designed to operate like a pro. Featuring • 3½ digit LCD • low BAT. indicator • all range overload protection • overrange indication • auto-polarity •Transistor tester • dual-slope integration • vinyl carrying case

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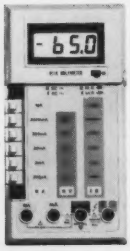
h_{FE} test leads, battery & vinyl carrying case included



RAMSEY D-3100 DIGITAL MULTIMETER

Reliable, accurate digital measurements at an amazingly low cost • In-line color coded push buttons, speeds range selection • abs plastic tilt stand • recessed input jacks • overload protection on all ranges • 3½ digit LCD display with auto zero, auto polarity & low BAT. indicator

$59.95

test leads and battery included

CT-70 7 DIGIT 525 MHz COUNTER

Lab quality at a breakthrough price. Features • 3 frequency ranges each with pre amp • dual selectable gate times • gate activity indicator • 50mV @ 150 MHz typical sensitivity • wide frequency range • 1 ppm accuracy

$119.95

wired includes AC adapter

CT-70 kit $99.95
BP-4 nicad pack 8.95

CT-90 9 DIGIT 600 MHz COUNTER

The most versatile for less than $300. Features 3 selectable gate times • 9 digits • gate indicator • display hold • 25mV @ 150 MHz typical sensitivity • 10 MHz timebase for WWV calibration • 1 ppm accuracy

$149.95

wired includes AC adapter

CT-90 kit $129.95
OV-1 0.1 PPM over timebase. . . $59.95
BP-4 nicad pack 8.95

CT-125 9 DIGIT 1.2 GHz COUNTER

A 9 digit counter that will outperform units costing hundreds more. • gate indicator • 24mV @ 150 MHz typical sensitivity • 9 digit display • 1 ppm accuracy • display hold • dual inputs with preamps

$169.95

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CT-125 kit $149.95
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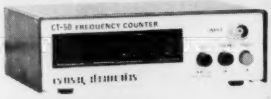

CT-50 8 DIGIT 600 MHz COUNTER

A versatile lab bench counter with optional receive frequency adapter, which turns the CT-50 into a digital readout for most any receiver • 25 mV @ 150 MHz typical sensitivity • 8 digit display • 1 ppm accuracy

$169.95

wired

CT-50 kit $139.95
RA-1 receiver adapter kit 14.95

DM-700 DIGITAL MULTIMETER

Professional quality at a hobbyist price. Features include 26 different ranges and 5 functions • 3½ digit, ½ inch LED display • automatic decimal placement • automatic polarity

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MP-1 probe set 4.95

PS-2 AUDIO MULTIPLIER

The PS-2 is handy for high resolution audio resolution measurements. multiplies UP in frequency • great for PL tone measurements • multiplies by 10 or 100 • 0.01Hz resolution & built-in signal preamp/conditioner

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wired includes AC adapter

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PR-2 COUNTER PREAMP

The PR-2 is ideal for measuring weak signals from 10 to 1,000 MHz • flat 25 db gain • BNC connectors • great for sniffing RF • ideal receiver/TV preamp

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Extends the range of your present counter to 600 MHz • 2 stage preamp • divide by 10 circuitry • sensitivity: 25mV @ 150 MHz • BNC connectors • drives any counter

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PS-1B kit $49.95

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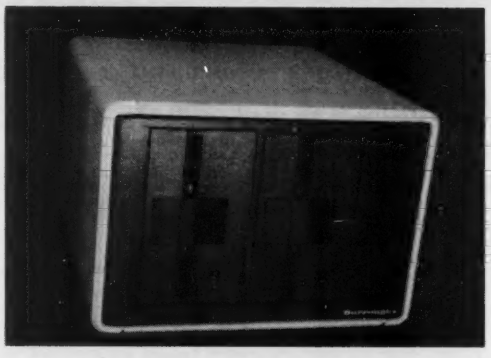
SELF STANDING COMPUTER TERMINALS

We acquired a small number of these beautifully made computer terminals which were made by a major U. S. manufacturer. We do not know all the details about them at press time, but we can tell you that someone lost over $2000 on each of them. They lose you win. The terminals feature 3 micro-processors for powerful capabilities, 106 key, Hall Effect ASCII keyboard, 10 user defineable keys, EAROMs, 16K RAM, 48K ROM, serial RS 232 asynchronous data communications, (synchronous optional), selectable baud rates of 75-38.4K BPS, high resolution, 12" green screen, composite video monitor, 80 X 25 line scrolling display, built-in reverse video option, self-contained, lightweight, tightly regulated switching power supply & more than can be fit in this space. The terminals were designed to be daisy chained around a central host computer and used as individual work stations. The host system could then selectively address any machine in the network for any message it may have. All units are visually inspected prior to shipment. An operators manual is provided w/ each unit.
Shpg. wt. 55 lb. model no. MT 686 $289.00
With the addition of our TP 420 dual FDD system below, you can create your own office system.

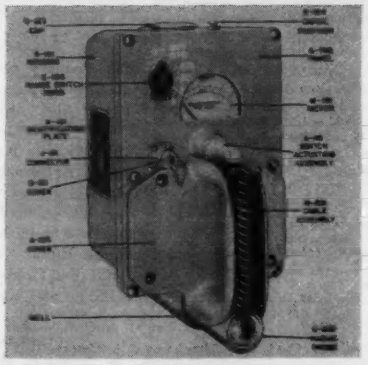
We offer the following as options: schematic pac. 3 lb.	$ 10.00
USRT for synchronous data comm. w/ installation data	$ 10.00
25' RS 232 cable, 1 male & 1 female DB 25 connector	$ 20.00

TP 420 DUAL MINI-FLOPPY DISC SYSTEM



The TP 420 is an extremely versatile mini floppy disc drive system. It consists of 2 Shugart SA 400 5¼" floppy disc drives, associated logic, controller card, power supply, cooling fan, and case. The TP 420 has a built in controller card which features: Z 80 A CPU, Z 80A DMA, Z 80A CTC, Intel 8271 controller chip, 6K RAM, ROM, plus other goodies. We have been told that the serial interface controller card within the TP 420 will support up to 4 8" drives from the unused port on it. The con troller card can be easily removed should you wish to use it on some other system. Also built in is a tightly regulated, switching power supply which runs on 115/230 v 50/60 hz.. The TP 420 is shipped w/ the interface cable for the MT 686, data, & schematics. Shpg. wt. 22 lb. Stock no. TP 420 $300.00

PDR-27 NAVY RADIATION METER



Just released by the US Navy. They appear to be in excellent condition and include the fitted aluminum transit case. Batteries not furnished but are available in most electronic supply houses. 4 ranges 0.5 to 500 mr/hr. Removeable hand probe, detection of Beta and Gamma radiation. With todays world conditions and perhaps proximity to a nuke power station, it might provide a little insurance to own one of these instruments. With no facilities to check or test, we offer AS IS, visually OK Schematic provided with each. We have some accessories and offer as an option although not required for operation.
Shipping wgt. 22 lb. PDR-27 Rad Meter $50.00

PDR-27 phones $7.00	Approx. 100 page Instr. Book $10.00
Hi Sensitivity GM tube $10.00	Low Sensitivity GM tube $5.00

The above listed tubes are already installed in the meter.
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ARGENTINA	14	7	7	7B	7B	7	14	21A	21A	21A	21A	14A
AUSTRALIA	21	14	7B	7B	7B	7B	7B	14B	14B	14	21A	21A
CANAL ZONE	14	7	7	7	7	7	14	14A	21	21A	21	14A
ENGLAND	7	7	3A	3A	3A	3AB	14	21	21A	14	14B	7
HAWAII	21	14	7B	7	7	7	3A	14B	14	21	21A	21A
INDIA	14B	7B	7B	7B	7B	7B	14	14A	14	14B	14B	14B
JAPAN	14A	14B	7B	7B	7	7	7	7B	7B	7B	7B	14A
MEXICO	14A	7	7	7	7	7	7	14	14A	21A	21A	21
PHILIPPINES	14A	7B	7B	7B	7B	7B	7B	7B	14B	14B	14B	14
PUERTO RICO	14	7	7	7	7	7	14	14A	21A	21A	21	14A
SOUTH AFRICA	14	7	7	7	7B	7A	21	21A	21A	21A	21	14A
U. S. S. R.	7	3A	3A	3A	7	7B	14	21	14	14B	7B	7B
WEST COAST	21	14	7	7	7	3A	7	14	21A	21A	21A	21

CENTRAL UNITED STATES TO:

ALASKA	14A	14	7	3A	3A	3A	3A	3A	7A	14	21	21
ARGENTINA	14	7	7B	7B	7B	7	7A	21	21A	21A	21A	21
AUSTRALIA	21	14A	7B	7B	7B	7B	7B	7B	14B	14	21A	21A
CANAL ZONE	14	7	7	7	7	7	7A	14A	21	21A	21	21
ENGLAND	7	7	3A	3A	3A	3AB	7B	14	21A	14	14B	7B
HAWAII	21A	14A	7	7	7	7	3A	7	14	21	21A	21A
INDIA	14B	14B	7B	7B	7B	7B	7B	14B	14B	14B	14B	14B
JAPAN	21	14	7B	7B	7	7	7	7	7B	7B	14B	14A
MEXICO	14A	7	7	7	7	7	7	14	14A	21A	21A	21
PHILIPPINES	21	14	7B	7B	7B	7B	7B	7	14B	14B	14B	14A
PUERTO RICO	14	7	7	7	7	7	7A	14A	21A	21A	21	14A
SOUTH AFRICA	14	7	7	7	7B	7B	14	21	21A	21A	21	14A
U. S. S. R.	7B	3A	3A	3A	7	7B	7B	14	14	14B	7B	7B

WESTERN UNITED STATES TO:

ALASKA	21	14	7A	3A	3A	3A	3A	3A	7A	14	21	21
ARGENTINA	14A	14	7B	7B	7B	7	7B	14	21A	21A	21A	21
AUSTRALIA	21A	21	14	14B	7B	7B	7B	7B	14B	14	21A	21A
CANAL ZONE	14A	7A	7	7	7	7	7	14	21	21A	21A	21
ENGLAND	7B	7	3A	3A	3AB	3AB	7B	14B	14A	14	14B	7B
HAWAII	21A	21	14	7A	7	7	7	7	14	21	21A	21A
INDIA	14	14A	14B	7B	7B	7B	7B	7B	14B	14B	14B	14B
JAPAN	21A	21	14B	7B	7	7	7	7	7	7B	14	21A
MEXICO	21	14	7	7	7	7	7	7	14A	21	21A	21A
PHILIPPINES	21A	21	14B	7B	7B	7B	7	7	14B	14B	14B	21
PUERTO RICO	14A	14	7	7	7	7	7	14	21	21A	21A	21
SOUTH AFRICA	14	7	7	7	7B	7B	7B	14	21	21A	21	14A
U. S. S. R.	7B	3AB	3AB	3AB	3AB	7B	7B	14B	14	14B	7B	7B
EAST COAST	21	14	7	7	7	3A	7	14	21A	21A	21A	21

A = Next higher frequency band may also be useful.
B = Difficult circuit this period.

First letter = night waves. Second = day waves.
G = Good, F = Fair, P = Poor. * = Chance of solar flares.
 # = Chance of aurora.

NOTE THAT NIGHT WAVE LETTER NOW COMES FIRST.

February

SUN	MON	TUE	WED	THU	FRI	SAT
			1 F/F	2 F/G	3 F/G	4 G/G
5 G/G	6 G/G	7 F/F	8 F/G	9 G/G	10 G/G	11 F/G
12 F/G	13 P/F	14 P/F	15 F/F	16 F/G	17 F/G	18 F/G
19 F/G	20 G/G	21 G/G	22 G/G	23 G/G	24 F/F	25 P/F
26 P/F	27 F/F	28 F/F	29 F/F			

FT-77 The Rig for All Seasons!

Answering the call for an HF rig that goes everywhere, sounds great, and is cost-effective, Yaesu proudly introduces the FT-77 Compact HF Transceiver System.

Computerized Design and Manufacture

The FT-77 design engineers utilized the latest computerized circuit board layout methods, resulting in a compact, reliable transceiver with maximum utilization of available space. Automated insertion techniques are used in assembly, providing improved reliability and quality control over earlier designs.

Operating Versatility

The FT-77 is equipped for operation on all amateur bands between 3.5 and 29.7 MHz, including the three new WARC bands. Fully operational on SSB and CW, the FT-77 includes a dual width noise blanker (designed to minimize the "Woodpecker" or ignition noise), full SWR metering, R.I.T., and optional CW filter with wide/narrow selection. The optional FM-77 permits operation on the FM mode, with front panel squelch sensitivity control.

Expandable Station Concept

Ideal for mobile operation because of its compact size and light weight, the FT-77 forms the nucleus of a versatile base station. Available as options for the FT-77 are the FP-700 AC Power Supply, FV-700DM Synthesized External VFO and Memory System, FTV-707 VHF/UHF Transverter, and FC-700 Antenna Coupler, providing top performance at an extraordinarily low price.

Best of All, It's a Yaesu!

With most experience in transceiver design and manufacture, the Yaesu trademark is your guarantee of quality and durability. We've got all-new technology and an all-new warranty policy to back it up.

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Digital DX-terity...

General coverage, Superior dynamic range, 2 VFO's, 8 memories, Scan, Notch...COMPACT!

TS-430S

The TS-430S combines the ultimate in compact styling with advanced circuit design and performance. An all solid-state SSB, CW, and AM transceiver, with FM optional, covering the 160-10 meter Amateur bands, it also incorporates a 150 kHz-30 MHz general coverage receiver having a superior dynamic range, dual digital VFO's, 8 memories, memory scan, programmable band scan, IF shift, notch filter, all-mode squelch, and built-in speech processor.

TS-430S FEATURES:

- **160-10 meter operation, with general coverage receiver**
  With 160-10 meter Amateur band coverage, including WARC 30, 17, and 12 meter bands, it also features a 150 kHz-30 MHz general coverage receiver. Innovative UP-conversion digital PLL circuit, for superior frequency stability and accuracy. UP/DOWN band switches for Amateur bands or 1-MHz steps across entire 150 kHz-30 MHz range. Two digital VFO's continuously tuneable from band to band. Band information output on rear panel.
- **USB, LSB, CW, AM, with optional FM**
  Operates on USB, LSB, CW, and AM, with optional FM, internally installed. AGC time constant automatically selected by mode.
- **Compact, lightweight design**
  Measures only 10-5/8 (270) W x 3-3/4 (96) H x 10-7/8 (275) D, inches (mm), weighs only 14.3 lbs. (6.5 kg.).
- **Superior receiver dynamic range**
  Use of 2SK125 junction-type FET's in the Dyna-Mix high sensitivity, balanced, direct mixer circuit provides superior dynamic range.
- **10-Hz step dual digital VFO's**
  10-Hz step dual digital VFO's operate independently, include band and mode information. Different band and mode cross operation possible. Dial torque adjustable. STEP switch for tuning in 10-Hz or 100-Hz steps. A=B switch quickly shifts "B" VFO to the same frequency and mode as "A" VFO, or vice-versa. VFO LOCK switch provided. RIT control tunes VFO or memory. UP/DOWN manual scan possible using optional microphone.
- **Eight memories store frequency, mode, and band data**
  Memories store frequency, mode, and band data. Eighth memory stores receive and transmit frequencies independently. M.CH switch for operation of memory as independent VFO, or fixed frequency.
- **Lithium battery memory back-up**
  Estimated five-year life.
- **Memory scan**
  Scans memories in which data is stored.
- **Programmable automatic band scan**
  Scans programmed band width. Scan speed adjustable. HOLD switch interrupts band or memory scan.
- **IF shift circuit for minimum QRM.**
  IF passband may be moved to place interferring signals outside the passband, for best interference rejection.
- **Tuneable notch filter built-in**
  Deep, sharp, tuneable, audio notch filter.
- **Narrow-wide filter selection**
  NAR-WIDE switch for IF filter selection on SSB and CW when optional filters are installed. (2.4 kHz IF filter built-in.)
- **Speech processor built-in**
  Improves intelligibility, increases average "talk-power."
- **Fluorescent tube digital display**
  Indicates frequency to 100 Hz (10 Hz modifiable).
- **All solid-state technology**
  Input rated 250 W PEP on SSB, 200 W DC on CW, 120 W on FM (optional), 60 W on AM. Built-in cooling fan, multi-circuit final protection. Operates on 12 VDC, or 120/220/240 VAC with optional PS-430 AC power supply.
- **All-mode squelch circuit, built-in**
- **Noise blanker, built-in**
- **RF attenuator (20 dB)**
- **Vox circuit, plus semi break-in with side-tone**

Optional AT-250 Automatic Antenna Tuner
Designed to match the TS-430S in size, color, and appearance. Functionally compatible with any HF transceiver of 200 watts PEP or lower. (Requires manual bandswitching.)
• Covers 160-10 meter incl. WARC • ABC Automatic Band Changing System (when used with TS-430S) • SWR/Power meter • 4 antenna terminals • Built-in AC Power Supply.

Other optional accessories:

- PS-430 compact AC power supply.
- PS-30 or KPS-21 AC power supplies.
- SP-430 external speaker.
- MB-430 mobile mounting bracket.
- AT-130 compact antenna tuner, 80-10 m incl. WARC.
- FM-430 FM unit.
- YK-88C (500 Hz) or YK-88CN (270 Hz) CW filters.
- YK-88SN (1.8 kHz) narrow SSB filter.
- YK-88A (6 kHz) AM filter.
- MC-42S UP/DOWN hand microphone.
- MC-55 (8P) mobile microphone.
- MC-60A deluxe desk microphone.
- MC-80 UP/DOWN desk microphone.
- MC-85 multi-function desk microphone.

More information on the TS-430S is available from all authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, California 90220.

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Specifications and prices are subject to change without notice or obligation.